

FEBRUARY  
1960

PRICE 75 CENTS

# ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING



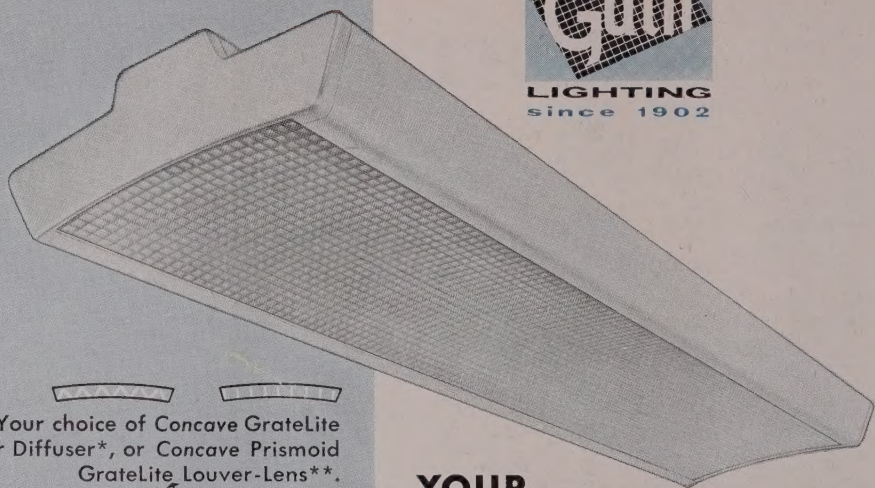
Electrical highlights of Long Island's new Aqueduct Race Track includes 5,000 kva power network and many special systems.



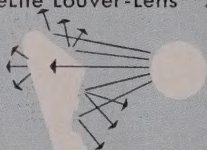
Underground substation serves Los Angeles' expanding Civic Center.

***How to select and apply the right fluorescent "white" lamp.***



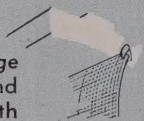


Your choice of Concave GrateLite Louver Diffuser\*, or Concave Prismoid GrateLite Louver-Lens\*\*.

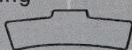
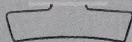


One-piece plastic side wings are tubular for added strength, lower side brightness, plus "reflector" efficiency. Ends are capped to simplify maintenance.

Concave GrateLites hinge separately from sturdy steel end plates for extra strength and easier servicing. No glue in Gateway!



Pendant mounting, or adaptable for close-ceiling mounting with top plates. For schools, stores and offices.



Available in 2, 3, or 4 light units ... in the same fixture width. 4' or 8' lengths.

## YOUR gateway ...TO RUGGED STRENGTH AND BEAUTY IN A CONCAVE PLASTIC FIXTURE

New Guth Gateway brings you "eye styled" beauty with sharp-line design and quality illumination. A new concept of fixture construction! Plastic is basic... but no wrap-a-round. Concave GrateLite bottoms hinge separately.

WRITE FOR GUTH  
GATEWAY BROCHURE TODAY!

THE EDWIN F. GUTH CO.

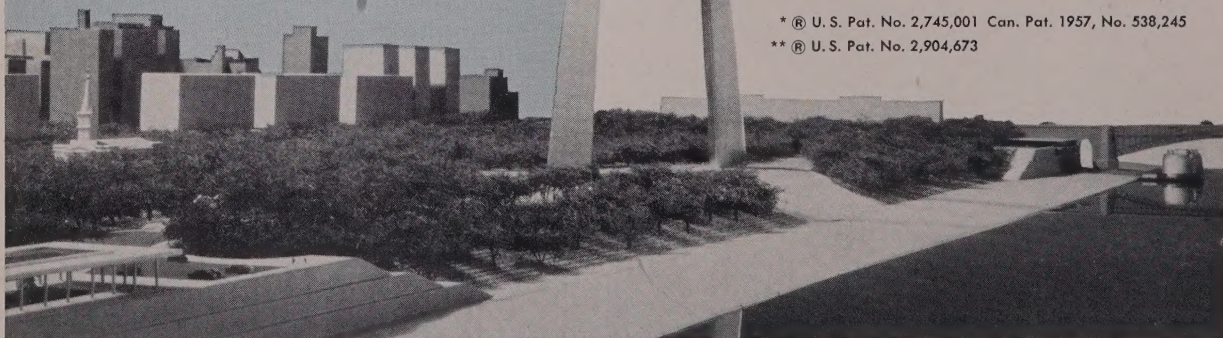
2615 WASHINGTON BLVD., BOX 7079, ST. LOUIS 77, MO.

From Model of the Saarinen Arch and Riverfront

Development, St. Louis, Mo.—"The Gateway to the West"

\* ® U. S. Pat. No. 2,745,001 Can. Pat. 1957, No. 538,245

\*\* ® U. S. Pat. No. 2,904,673





# Smaller Panels

## WITH SQUARE D "System-Designed" RELAYS

CLASS 8501  
TYPE DO-22

*Write for Bulletin D.*

Square D Company,  
4041 North Richards Street, Milwaukee 12, Wisconsin

• Square D relays are available for both AC and DC systems—with up to 10 contacts—in both electrically and mechanically held forms. Timing relays are also available in AC and DC versions—with timing intervals from 0.2 second to 3 minutes.

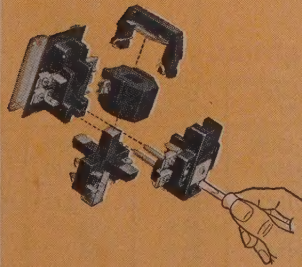
Both relays and timers give you these important advantages:

**Require less panel space** • Relays are only 3" wide, range in height from 3¼" to 5". Timers are just 2⅝" x 4⅜" or 2½" x 7⅞". Mechanically held relays require no extra panel space.

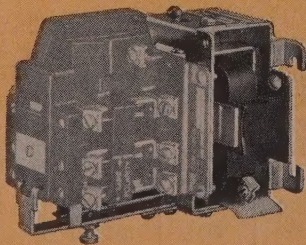
**No mounting problems** • All Type A timers and Type D relays have identical mounting hole dimensions.

**Easy wiring** • Choose either pressure wire connectors or slip-on connectors for all terminals.

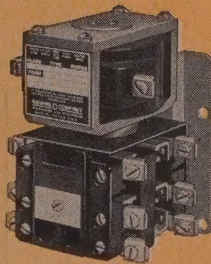
**Long life** • Balanced construction reduces wear on single moving part. Epoxy-resin molded coil operates cooler, virtually eliminates coil burnout.



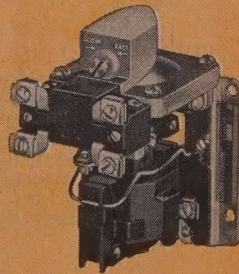
Disassembly from front in 20 seconds makes Square D Type D relays easiest to maintain



Convert any Square D Type D relay to mechanically held with easy-to-use attachment



DC relays have contact arrangements and mounting hole dimensions identical to AC



Timing relays convertible from on-delay to off-delay, using only a screwdriver

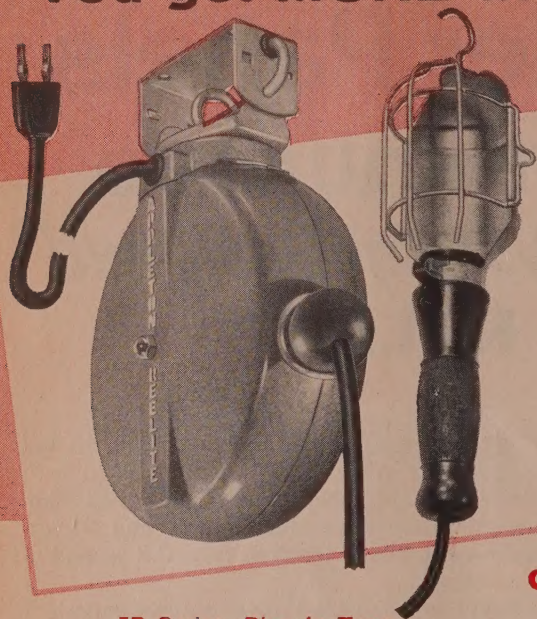
Square D offers the broadest line of relays, starters and accessories for all types of control systems

# SQUARE D COMPANY

wherever electricity is distributed and controlled



You get **MORE** when you choose an...



# APPLETON<sup>®</sup>

*portable*

## REELITE<sup>®</sup>

**Greater Selection...**

**Lower Cost with Finest Quality**

### 7P Series—Plug In Type

Unlimited mounting flexibility is built into this Reelite. Universal type mounting bracket for wall use. Hook eye for ceiling use. Plugs into receptacle. Positive stop action. Equipped with handlamp, guard, switch and half reflector.



APPLETON Reelites help prevent employee injuries due to extension cord entanglements.

No matter what the need, you'll find there's an APPLETON Reelite to do the job... a reel so sturdily built, so well engineered it's a bargain at the price.

Eliminate the hazards of tangled, twisted cords and assure yourself of durable equipment that gives years of service... by installing APPLETON portable Reelites.

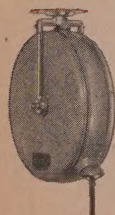
All APPLETON portable Reelite models are equipped with regular 2 or 3 conductor SJO cord. Where 3-conductor cord is used, the Reelite is grounded since the extra conductor is connected directly to the Reelite frame.

### 7S Series—Outlet Box Mounting



A finest quality Reelite with continuous 360° swivel action. Uninterrupted power with double silver alloy collector brushes. Handlamp must be ordered extra. Special vaporproof model is equipped with vaporproof handlamp.

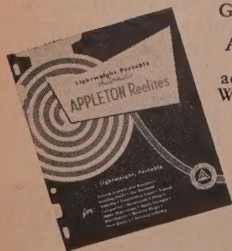
### 1500 Series—Outlet Box Mounting



Hanger plate fits neatly over any 4" octagonal outlet box. Up to 50 feet cord length depending on model. Handlamp must be ordered extra. \*Special light spring tension models for use by garment manufacturers. These models will not support weight of handlamp.

### Write for Descriptive Bulletin

Gives complete details on all models of APPLETON portable Reelites... with accessories illustrated. Write for Free Bulletin PRT 259



### Handy Order Information

| CATALOG NO. | CORD LENGTH | CORD TYPE | CATALOG NO. | CORD LENGTH | CORD TYPE |
|-------------|-------------|-----------|-------------|-------------|-----------|
| RE-7P2      | 25 Ft.      | 18-2 SJO  | RE-1519G    | 40 Ft.      | 18-3 SJO  |
| RE-7P2G     | 25 Ft.      | 18-3 SJO  | RE-1520     | 50 Ft.      | 18-2 SJO  |
| RE-7S2      | 25 Ft.      | 16-2 SJO  | RE-1520G    | 50 Ft.      | 18-3 SJO  |
| RE-7S2G     | 25 Ft.      | 18-3 SJO  | *RE-1521    | 25 Ft.      | 18-2      |
| RE-7SV2     | 20 Ft.      | 18-3 SJO  | *RE-1521G   | 25 Ft.      | 18-3      |
| *RE-1511    | 50 Ft.      | 18-2      | RE-1532     | 12 Ft.      | 16-2 SJO  |
| RE-1519     | 40 Ft.      | 16-2 SJO  | RE-1532G    | 12 Ft.      | 18-3 SJO  |

**Only APPLETON Makes Reelites**

**APPLETON ELECTRIC COMPANY**  
1701 Wellington Avenue • Chicago 13, Illinois

Also  
Manufacturers  
of:



"Eagle Claw"  
Switch Boxes



Malleable Iron  
Unilets



Explosion-Proof  
Hand Lamp



"ST" Series  
Connectors



# ELECTRICAL CONSTRUCTION AND MAINTENANCE

with which is consolidated Electrical Contracting, The  
Electragist and Electrical Record . . . Established 1901

Published for electrical contractors, electrical departments in industry, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management in the field of electrical construction and maintenance.

59H YEAR • FEBRUARY 1960

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MORE





## **“Simple enough change and really cuts installation time”**

You hear comments like this quite often when the Graybar Specialist joins an electrical contractor on the site.

The Graybar Specialist, backing up the salesman who calls, is there to work out the best installation method, to select equipment that's exactly right for the job, or show how to get the most from a special new tool.

He's well qualified to make this kind of assist, too. He's had years of training on the job and by the book. Working

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And remember, he's just one of several members of the Graybar electrical contractor service team. The others: the Graybar Field Salesman, Inside Salesman and Counterman. Their job is to *speed your work . . . reduce your costs . . . help you build your business.*

The Graybar service team is ready to work for you. Call them in.

916

**Graybar Service includes:** Objective recommendations. On-the-job technical help. Most complete lines. Planned stocks to meet your needs. Expert counter service. Speedy handling of will-calls.

# **GraybaR**

**ELECTRIC COMPANY, INC.**





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ELECTRICAL CONSTRUCTION and MAINTENANCE

FEBRUARY 1960

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*Ceiling diffusers, counter lighting and identification panels of PLEXIGLAS at Port Columbus Airport, Columbus, Ohio*

# PLEXIGLAS

FOR LIGHTING THAT STANDS OUT AND STANDS UP

The versatility of PLEXIGLAS® acrylic plastic as a lighting material is well demonstrated in the multiple uses shown above. To each application, PLEXIGLAS brings maximum efficiency in the transmission and diffusion of light. It also provides breakage-resistance, ease of cleaning, and freedom from discoloration. Above all, PLEXIGLAS has the permanent, quality appearance that complements good interior design.

We will be pleased to send you the names of manufacturers of lighting equipment that incorporates PLEXIGLAS.



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**ROHM & HAAS  
COMPANY**

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*In Canada: Rohm & Haas Company of Canada, Ltd.,  
West Hill, Ontario*



## Electrical Features at Aqueduct

Behind the gay facade of Aqueduct, world's newest racing track recently completed on Long Island, is an exceptionally complicated electrical installation serving many public facilities and a variety of special functions, from bar-stool observations of the race to security controls.

Power distribution at 4160 volts supplies nine substations serving 480/277 volts and 240/120-volt utilization circuits. A closed circuit TV system serves twelve 27-in. monitors and nine 4- by 6-ft projectors in the restaurants and lounges allowing patrons to follow the running and the results. Forty kw of floodlights bear on the finish line to supplement daylight and assure clean photo-finish pictures.

Details of the electrical work are described by E. F. Cassidy, electrical engineer, Stone & Webster Engineering Corp., in "A Modern Race Track" beginning on page 81.

## Electric Heat Show

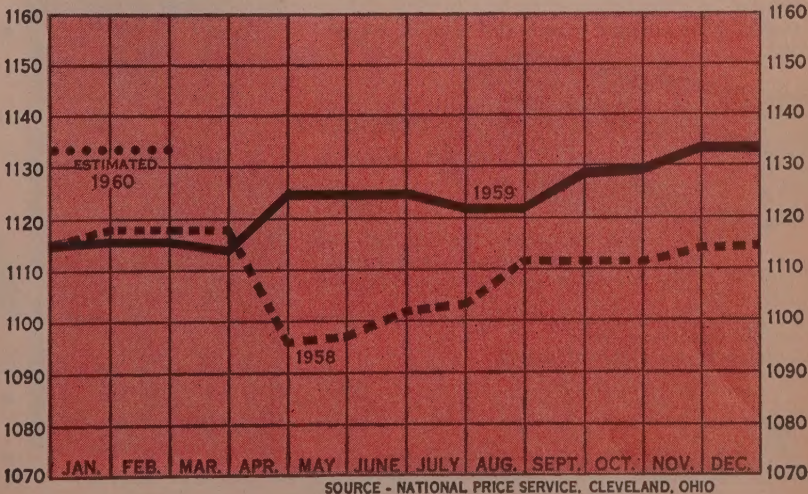
The first national exhibition and symposium on electric house heating, sponsored by the NEMA Electric House Heating Section, will be held in Chicago, Ill., at the Hotel Sherman, March 21-23. The show and the concurrent conference program are expected to attract an attendance of well over 2,000, including power suppliers, electrical distributors, electrical contractors, architects, engineers, builders, housing administrators and representatives of real estate and lending interests. The symposium will cover over 40 topics ranging from sales planning to application engineering and insulation techniques. A large attendance of electrical contractors is anticipated, because of their key role in the sales, design and installation of electric heating systems.

## Underground Substation

What to do with a large electrical substation in an area devoted to monumental government buildings can pose a problem. In Los Angeles, the city power authorities decided to go underground for a new 60,000-kva substation serving the rapidly expanding Civic Center comprising State, County and City administrative buildings. The high banks of a depressed freeway provided the location; landscaping and terracing over the station roof completely conceal the ground level ventilation grilles. The substation, 100 ft long, is unattended. It houses the 34.5-kv breakers and bus, three 20,000-kva transformers in separate vaults and 5-kv metal clad distribution switchgear. Details of the electrical work performed by Berg Electric Company and Department forces are described by Frederick B. Hyde, Electrical Engineering Associate, Department of Water and Power, City of Los Angeles, in the article, "60,000-KVA Station Goes Underground" beginning on page 90.

### ELECTRICAL MATERIALS COST INDEX

BASE LINE (1000) REPRESENTS COSTS OF TYPICAL ASSORTMENT OF MATERIALS FOR A SELECTED JOB AS OF NOVEMBER 1, 1951. INDEX POINTS REPRESENT THE VARIATION OF THESE SAME MATERIAL COSTS AS OF THE FIRST OF EACH MONTH.



SOURCE - NATIONAL PRICE SERVICE, CLEVELAND, OHIO



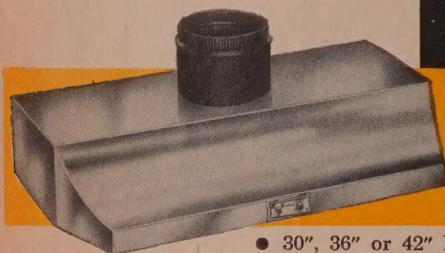
# Broan Kitchen Range Hoods

Give You the Advantages You Want

- ✓ strong customer appeal
- ✓ fast-running installation
- ✓ solid competitive price
- ✓ balanced complete line

GREAT PERFORMERS, these Broan Kitchen Range Hoods . . . so right in line for every kitchen requirement . . . and so right in color, style, function and price. Even more, "in-place" time is often cut in half because a Broan hood reaches you prewired, fully packaged, ready for fast-running field installation. Discover how you can put these basic features, these lower costs to work for you . . . and come out ahead of competition with Broan Range Hoods doing your bidding.

"the greatest eye appeal of any hood designed for ductless service"



**Project Range Hood**

- 30", 36" or 42" hood in a range of finishes
- 8" fan with backdraft damper
- reduces to accept 8" round duct
- lifetime aluminum filter, prewired pushbutton controls
- beveled front corners permit full use of cabinet doors



**Standard Range Hood**

- removable, reversible top plate with rectangular and circular knockout easily adaptable to any three Broan exhaust units.
- has lifetime filter; "No Glare" lighting; push-button controls factory prewired.
- available in an array of colors.



**Broan**

MANUFACTURING COMPANY, INC.

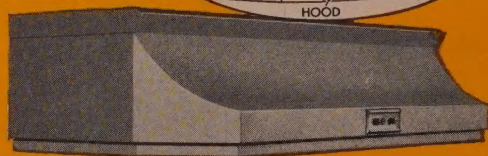
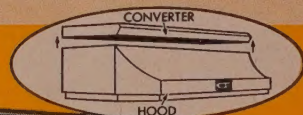
948 West State Street, Hartford, Wisconsin (near Milwaukee)  
Specialists in Quality Ventilating Equipment for Over 25 Years

A Great New Idea  
in Ductless Hood Service

## The Broan Refresh-Aire Converter\*

- converts any Broan Dual Blower Hood to ductless service
- a slim line charcoal housing, converter mounts directly on top of the Dual Blower Hood
- can be readily removed should duct outlet be desired in the future
- equipped with effective charcoal filter that absorbs cooking odors and smoke . . . refreshes air
- louvers are out of sight, so ductless unit looks like a conventional hood
- available in colors and sizes to match any Dual Blower Hood

\*Patent applied for.



**Dual Blower Hood**

- knockout plates for horizontal or vertical discharge
- dual blower provides extra pressure needed for long duct runs and elbows
- spring-loaded backdraft damper prevents cold drafts and damper flutter
- combined blower and hood saves on cabinet space . . . cuts installation costs in half
- has light with ribbed crystal lens, accommodation for 100 watt bulb; blower with twin air intake; twin lifetime aluminum filters.



**Dual Blower Island Hood**

- completely self contained; offers fast, economical installation
- combines all the engineering features and advantages of the regular Broan Dual Blower Hood.



# Washington Report

FEBRUARY • 1960

**President Eisenhower's budget proposed for fiscal 1961 shows surplus** of \$4.2 billion, with a total expenditure of \$79.8 billion, second highest in peacetime. Expenditure would go for: 1) major national security programs—\$45.6 billion; 2) interest on national debt—\$9.6 billion; 3) agriculture—\$5.6 billion; 4) veterans—\$5.5 billion; and 5) all other—\$13.5 billion. Income would total \$84.0 billion, it is estimated, from these sources: 1) individuals—\$43.7 billion; 2) corporations—\$23.5 billion; 3) excise taxes—\$9.5 billion; 4) all other—\$7.3 billion.

In his annual economic report to Congress, President Eisenhower predicted that the current business rise can continue for two more years, or through 1961, with "appropriate private actions and public policies." The current economic expansion dates back to mid-1958.

**The steel strike settlement has spurred business gains** and positive benefits which government officials generally view as "healthy" expansion. These unquestionably include: 1) better production schedules, with dependable flow of raw materials and parts; 2) higher employment; and 3) expanding personal income. Expansion has not developed into "boom" proportions, it is believed, but some inflationary dangers may be developing.

**Department of Commerce announced appointment of Frederick L. Graf** as advisor to the director, Electrical Equipment Division, Business and Defense Services Administration. Mr. Graf is sales manager in the switchgear department of Westinghouse Electric Corp., Pittsburgh, and goes to BDSA on loan from his company for temporary duty without compensation from the government.

**Heavy electrical equipment manufacturers in the U. S. will get no protection** against foreign imports, it has been ruled by Office of Civil Defense Mobilization. American manufacturers had, in March, 1958, appealed for quotas on all imports of large transformers, circuit breakers, generators, and turbines for hydroelectric power plants. OCDM's ruling was based on the premise that these imports are not threatening national security.

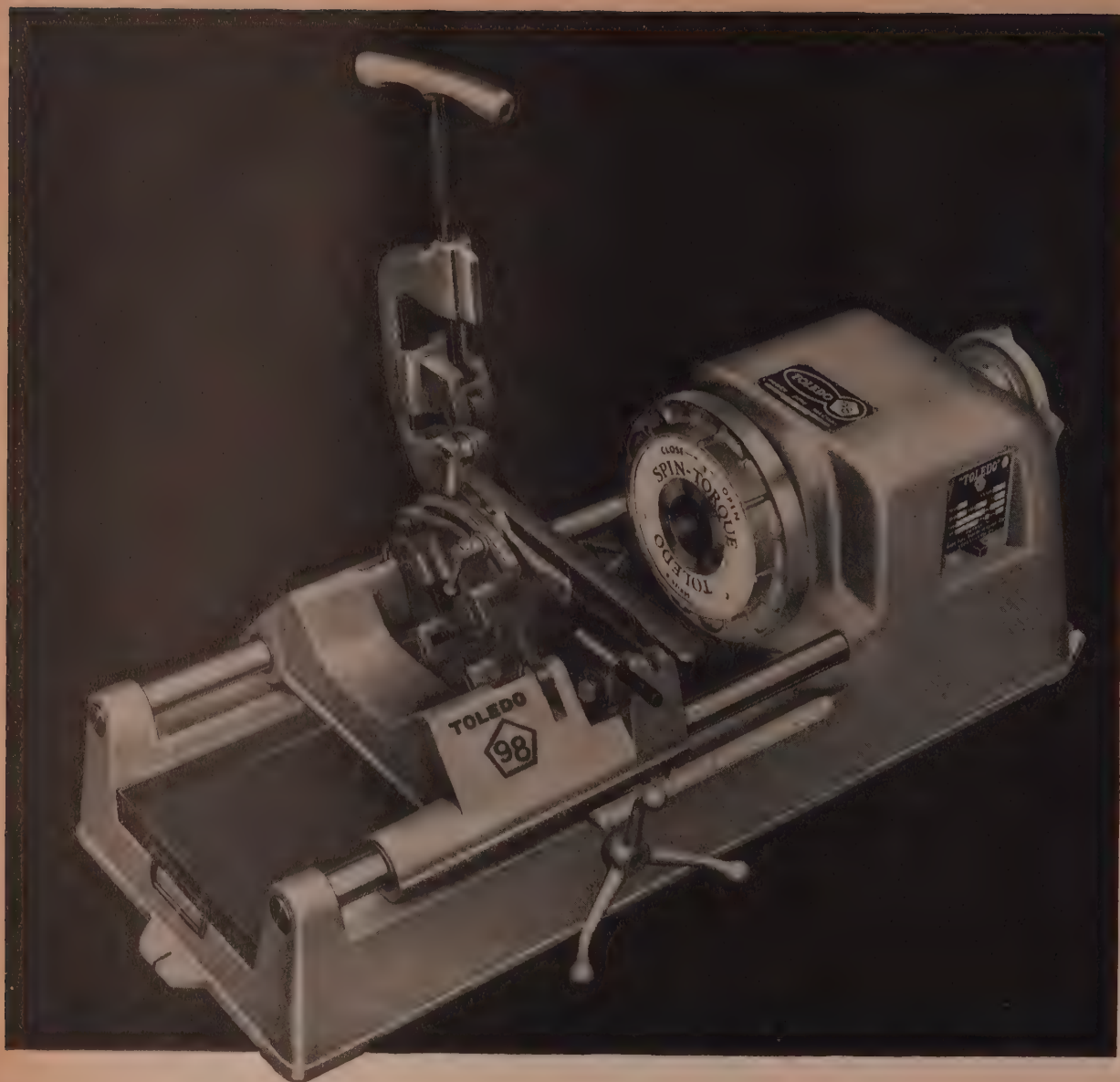
**Industrial production in December soared to 165%** of the 1947-49 average, near the 166% record reached in May and June of last year. This was a gain of nine percentage points over November, or 6%, and was the largest increase for a single month in recent years.

**Employment rose between November and December** by 59,000, to a new December record of 65,699,000. Also, unemployment declined during this period when it ordinarily would have increased. Both were caused largely by a quick rebound after the steel strike, Labor Dept. reported.

**Personal income rose in December to a record** of \$390.7 billion seasonally-adjusted annual rate, up \$3.8 billion from the November annual rate. This put personal income for the year 1959 at \$380.1 billion, or \$21.1 billion above 1958's \$359.0 billion. President Eisenhower's fiscal 1961 budget estimate assumes personal income will climb to \$402 billion for 1960 calendar year.

**New construction spending in 1959 climbed to a record** \$54.3 billion, despite the steel strike, and up from 1958's record of \$48.9 billion. The value of new construction for December was only \$4.1 billion, however, same as in December 1958, and down from the November 1959 total of \$4.4 billion.





## NOW! Alcoa Aluminum helps you cut, thread and ream faster...with the all-new Toledo "98"

Toledo turned to the *light, strong* metal when they designed their new "98" pipe threading machine! Packed with new features, the "98" speeds cutting, threading and reaming of all pipe sizes up to 2 in.—conduit and bolts, too. And, because it's cast in Alcoa® Aluminum, the new unit is compact, weighs only 180 lb, is easy to transport anywhere!

Other features include a full 10 in. of travel, with rugged cast aluminum carriage plus new aluminum chuck, with no protruding jaws—you can work within 1 in. of face without worrying about chips!

And that's not all! This new designed-in-aluminum "98" boasts highly improved working visibility . . .

spindle bearings lubricated at the factory . . . faster, easier spout positioning to put coolant directly on work . . . and the famous Toledo motor, power-packed and readily accessible!

For more information, contact Aluminum Company of America, 2071-B Alcoa Building, Pittsburgh 19, Pa.

CHOOSE PRODUCTS MADE  
WITH ALCOA ALUMINUM TO  
MAKE YOUR JOB EASIER





**On a job like the Illuminating Building...**

**Harrington Electric figures costs closely  
...but doesn't take chances!**

**Y**ou'd expect to see quality products on jobs like The Illuminating Building—including, of course, Burndy connectors. Harrington Electric Company, contractors on this \$2,000,000-plus electrical job, used Burndy connectors throughout the 5500 KVA electrical system...and at a cost less than 1/6 of 1% of the total. Harrington figures costs closely...but knows that it doesn't pay to take chances with the connections that safeguard the dependability of eleven high-speed elevators, 2200 tons of air conditioning and a lighting system that provides from 50 to 400 foot candles of office illumination in the 400,000 square foot building.



"When handling a large job, such as The Illuminating Building, a contractor doesn't have time to check into the many imitations of Burndy on the market, to see if the savings they

offer are worth the chance of making a poor connection. Therefore, I use Burndy because I know from past experience that I can depend on the quality to be consistently good, at a fair price."

—Al Fuerst, Vice President; Harrington Electric Co., Cleveland, Ohio

The Illuminating Building, Cleveland, Ohio  
Owner—55 Public Square, Inc., Robert Arnow, President  
Managing Agents—Ostendorf-Morris Company  
Architects—Carson and Lundin, New York  
Consulting Engineers—McGeorge-Hargrett & Associates

# BURNDY

ELECTRICAL CONNECTORS

NORWALK, CONNECTICUT • BURNDY LTD., (INCORPORATED) ENGLAND • IN BELGIUM: E. J. DE WITTE, ANTWERP, BELGIUM • TORONTO, CANADA



# 6 bonuses

## bonus NO. 1 . . . EXTREME QUIETNESS

Quiet transformer operation with low loss is a blessing and a real source of satisfaction to building owners, managers, top executives, employees and patrons. Therefore a superior low noise level is an extremely important reason why you should specify and/or install PTC transformers on all jobs.

Look at these PTC low noise levels as they compare with present and recommended NEMA specifications.

| KVA<br>Transformer Rating | Present<br>NEMA | Precision Average Sound Level<br>Standard Design | Special Design |
|---------------------------|-----------------|--------------------------------------------------|----------------|
| 9-30                      | 50              | 40                                               | 34             |
| 37½-112½                  | 55              | 42                                               | 38             |
| 125-167                   | 60              | 44                                               | 42             |
| 200-300                   | 62              | 48                                               | 46             |

To recognize the extreme quietness of PTC transformers it is best to compare them in decibel sound level ratings with those of typical sounds familiar to everyday life.

### FOR EXAMPLE:

60-70 decibels—the sound of one typewriter or average traffic sounds 100 ft. away.

50-60 decibels—the sound of a vacuum cleaner or moderate restaurant clatter.

40-50 decibels—the noise to be found in an average residence or in normal conversation.

30-40 decibels—low conversation in a residence in the evening.

## bonus NO. 2 . . . EFFICIENCY

Transformer losses cost money. Precision transformer cores **1** use the lowest loss steel available. Precision transformers are wound with low resistance copper wire and designed for the greatest possible operation economy. These features reduce losses and save dollars not once, but year after year.

## bonus NO. 3 . . . OVERLOAD CAPACITY

Precision transformers are designed with large open ducts **2** for efficient cooling and operate at lower temperatures than specified in national standards. Superior PTC insulation materials, varnishes and wire enamels actually permit operating temperatures in excess of these standards with no loss of life. These factors together with low losses give Precision transformers unequalled ability to handle overloads.

## bonus NO. 4 . . . DEPENDABILITY AND LONG LIFE

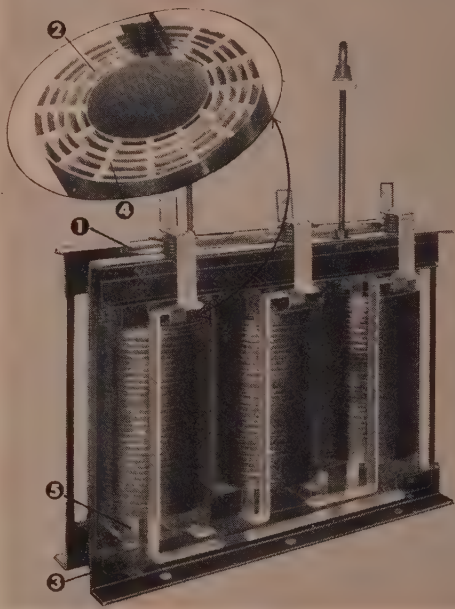
Dependability and long life can result only from ADVANCED DESIGN and BUILT-IN QUALITY. PTC transformers excel because they are constructed to meet the varying conditions under which they must be used. Additional PTC features are:

- Core laminations are clamped together with structural steel **3** rather than formed sheet steel for more rugged construction.
- Glass laminate duct spacers **4** used provide greater toughness, rigidity, dimensional stability, and moisture resistance far in excess of wood or paper phenolic laminate spacers.
- Coils are thoroughly clamped and braced around the core with fibre-glass laminate insulating blocks **5** resulting in greatest structural and tensile strength.
- Coils are made with an interlayer and interwinding insulation of Mylar-Quinterra and glass, assuring high dielectric strength, low moisture absorption and high temperature stability characteristics.

when you specify  
and/or install

# PTC

TRANSFORMERS



## bonus NO. 5 . . . REDUCED INSTALLATION EXPENSE

Well designed and easily accessible mounting provisions together with ample connecting space and simple wiring termination mean neater installations at lower than normal cost.

## bonus NO. 6 . . . THE ONLY 5-YEAR UNCONDITIONAL GUARANTEE IN THE INDUSTRY

Your reputation as an electrical engineer or contractor depends upon YOUR ability to stand firmly behind your recommendations and installations.

It is reassuring to know that PTC transformers work because PTC people make them work — then stand unconditionally behind them.

### WHISPER-QUIET INSIDE-THE-WALL INSTALLATION

Precision Transformer Corporation has developed a unit which installs *inside-the-wall* in otherwise unusable space. Precision's "HUSH-FLUSH" design permits easy, full accessibility, lowest noise level close to lead power service. Saves material and labor costs. Ideal for schools, libraries, hospitals, churches, theatres, etc. — wherever noise *must* be eliminated.

### Complete Line—DRY and LIQUID Types

Whatever your transformer needs, there is a dependable, quiet, long-lasting dry or liquid type transformer . . . more than 4,000 models ranging from ¼ to 5,000 KVA.

Write today for 4-page brochure providing details on the PTC line.



- QUIET
- EFFICIENT
- DEPENDABLE

## PRECISION TRANSFORMER CORP.

2222 West Lake Street

Chicago 12, Illinois

Representatives in all principal cities



# C-L-X INTEGRATED CABLE SYSTEM

Requires no separate Duct or Conduit  
in any environment



Unusual pliability of C-L-X Sheathed Cables is shown here as the cable is being installed.



The revolutionary C-L-X Continuous, Corrugated, Lightweight, metallic sheath, that Simplex introduced to this country two years ago, is now available in *Aluminum*, *Copper* or *Bronze* as well as the enormously successful *Steel*.

Simplex C-L-X pliable cable systems provide unexcelled ease of installation and mechanical protection.

The *corrugated* metal sheath combines pliability for ease of installation with very great strength and seals the cable against penetration by oil, chemicals and moisture.

Depending on the environmental conditions of the installation, these power, control and communication cable systems can be furnished with or without plastic jacketing.

Light, and pliable, C-L-X cables are easily installed, and require no special reels.

Now, with corrugated *Aluminum*, *Copper* or *Bronze* sheathed C-L-X cable systems, the low resistance of these metals permits designs where the sheath may be used as a neutral or ground. These metals also permit the use of single as well as multiconductor cable assemblies in a-c power systems.

For complete details on C-L-X sheathed cables, contact your Simplex Engineer, or write direct.

*Simplex*

WIRE & CABLE COMPANY

79 Sidney Street, Cambridge, Massachusetts



# New Gar-Lite Dualens Series\*

## Matched Series



4 lamp, 4'

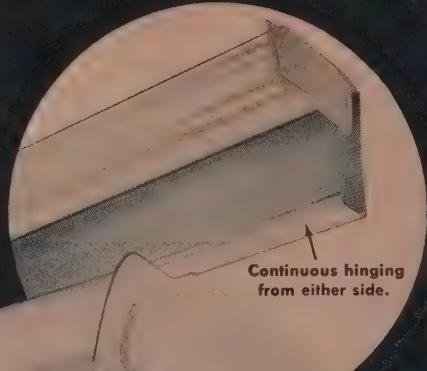


2 lamp, 2', 4' and 8'

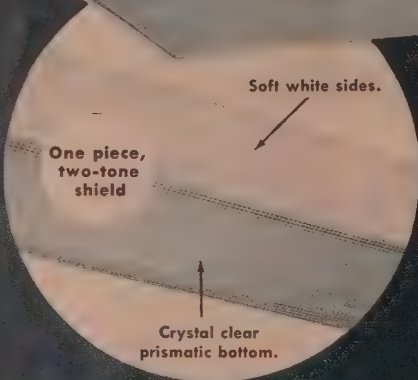
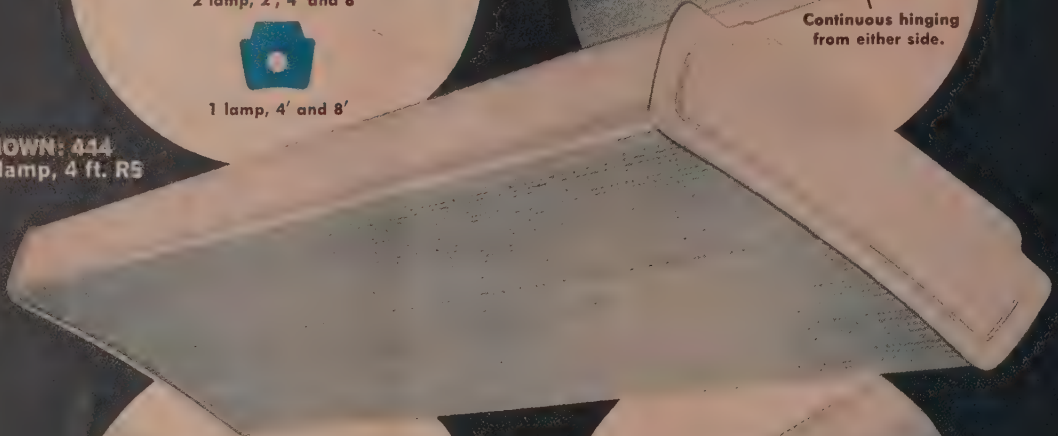


1 lamp, 4' and 8'

SHOWN: 444  
Four-lamp, 4 ft. RS



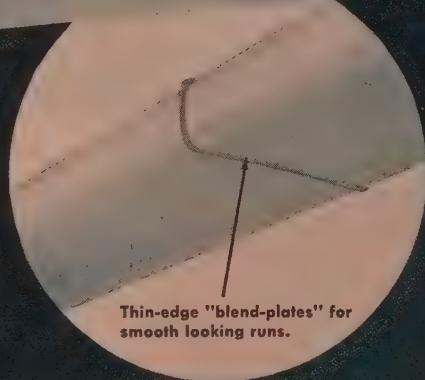
Continuous hinging  
from either side.



Soft white sides.

One piece,  
two-tone  
shield

Crystal clear  
prismatic bottom.



Thin-edge "blend-plates" for  
smooth looking runs.

## Sensibly priced lighting with matched series versatility

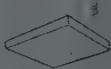
Don't overlook the new Gar-Lite Dualens Series. No other low priced, top quality fixture can offer you this matched series versatility — six fixtures, in lengths and lamps to meet every requirement.

And it's hard to equal the many exclusive built-in features found in the Dualens Series... features seldom found even in higher priced fixtures.

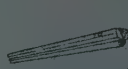
The complete Gar-Lite economy line includes these quality fixtures.



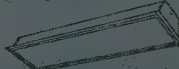
Louvered



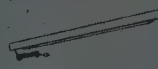
Surface 2' x 2'



Strip Light



Troffer



Utility Light



Show Case Light



Wall Light

**GARCY LIGHTING**

Div. of Garden City Plating & Mfg. Co.  
2475 Elston • Chicago 47, Ill.

Write for your  
Gar-Lite  
brochure today.





# CRESCENT

SERVICE ENTRANCE CABLE

With Mylar\* Tape



*Gives Greater Flexibility—  
Faster, Neater Installation*

A color-coded MYLAR Tape is used over the rubber insulation on each conductor, giving excellent protection at terminations. A MYLAR Tape is also used over the concentric neutral conductors, which keeps the strands clean, insuring a fast, good conduction at lowest installed cost.

\*DU PONT  
Reg. T.M.



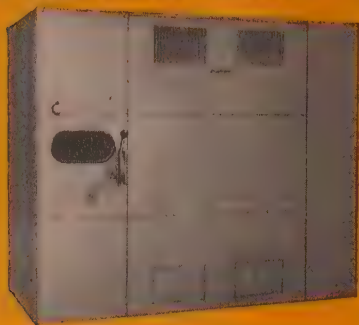
**CRESCENT INSULATED WIRE & CABLE CO., INC.**



TRENTON, NEW JERSEY



# WAGNER UNIT SUBSTATION TRANSFORMERS



**VENTILATED DRY-TYPE**—For indoor installation in reasonably dry, dust-free, well ventilated locations. Light in weight, ideal for multi-story buildings. No fireproof vaults required. Insulated for 80°C temperature rise.

112½ to 2000 Kva—three phase,  
60 cycles, 15 KV and below

*for your plant's  
electrical system..*



**OIL-FILLED**—Generally installed outdoors. Can be used indoors in fireproof vaults. Outdoor transformers can be connected to indoor switchgear using weather-proof bus-duct. 55°C rise, self-cooled or forced-air cooled.

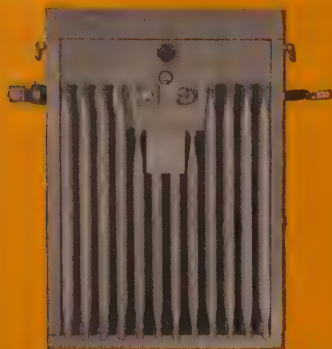
## SELECT WAGNER

There's a complete line of Wagner Industrial Transformers. One or more of them will fit your specific needs whether you're planning a new plant distribution system, modernizing your present one, or adding to its capacity to meet increasing demands for power. So, select and specify Wagner Transformers. They'll give you long, dependable service because:

All Wagner Industrial Transformers are liberally designed, sturdily constructed, thoroughly tested, and able to meet the heaviest industrial demands. You get continuous, dependable power for years.

For your main plant substation, Wagner Liquid-Filled Industrial Power Transformers are available in standardized ratings through 10,000 Kva.

Load centers? Wagner makes PREDESIGNED Unit Sub-



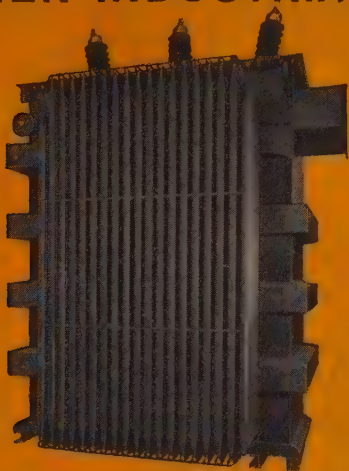
**NOFLAMOL**—Non-inflammable liquid-filled. For indoor or outdoor installation, especially suited for chemical plants, refineries and similar locations where explosive liquids or gases are present. The close-coupled design fits flush against switchgear enclosures to save space. Throat connected designs are also available. 55°C rise, self-cooled or forced-air cooled.



**SEALED DRY-TYPE**—Hermetically sealed in welded steel cases to provide positive protection from contamination, fire and explosion hazards. Sealed tank is filled with inert nitrogen. Only maintenance needed is periodic checking of gas pressure. Can be safely installed in any load center.



# WAGNER INDUSTRIAL POWER TRANSFORMERS



Oil-filled, for outdoor installations, available through 10,000 Kva, 67 KV and below.

Noflamol, non-inflammable liquid-filled for explosive atmospheres, available through 7,500 Kva, 15 KV and below.

The performance stability of Wagner Industrial Power Transformers is outstanding. Quality is designed and built into these transformers by specialists with years of transformer engineering and production experience. Highest quality materials...carefully controlled production methods...constant inspections and tests make sure these transformers give in-service performance that means better service for your system.

## INDUSTRIAL TRANSFORMERS

station Transformers to meet your particular requirements. Furnished with suitable incoming line sections, these transformers will save you time and job engineering costs. And, you can specify the secondary switchgear you prefer.

Wagner Dry-Type Distribution Transformers are an economical choice for plant areas requiring 120/240 volts, single-phase or 208Y/120 volts three-phase.

Over 65 years of constant research and development has made Wagner a leader in transformer design...made the name Wagner one of the foremost in power planning. For expert advice on your present and future plant transformer needs, call or write the Wagner branch near you.

*get economical,  
dependable,  
power packages!*

## Wagner Electric Corporation

6413 PLYMOUTH AVE., ST. LOUIS 33, MO., U. S. A.

## WAGNER DRY-TYPE DISTRIBUTION TRANSFORMERS



Single-phase 1 to 100 Kva—Three-phase 3 to 300 Kva—600 volts and below.

These dry-type distribution transformers have a low sound level, are compact and light in weight. They meet all safety requirements for indoor installation. They are economical to maintain... have no liquids, valves, gaskets or gauges.

Type AE, single-phase, 1 through 50 Kva, and Type AP, three-phase, 3 through 30 Kva, can be installed indoors or out. Larger ratings for indoor installations only. Ratings through 10 Kva single-phase are filled with an epoxy compound...operate quiet as a whisper...perfect for areas where noise would be a nuisance. They, and three-phase units through 30 Kva are designed for wall mounting...other ratings for floor or platform mountings.

Available for high voltages of 120 x 240, 240 x 480, 480 and 600 volts to 120/240 volts single-phase, and 480 and 600 volts to 208Y/120 volts three-phase.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

WT60-3



*Specify*

# McGILL® *Levolier*® switches

**...for guaranteed precision plus durability**



The high standards of design, craftsmanship and material selection make it possible to guarantee No. 41 LEVOLIER switch unconditionally against failure in lighting circuits. This extra quality is reflected in the performance of all LEVOLIER switches.

It pays to specify the best to avoid frequent and costly replacement. LEVOLIER canopy, toggle, push button and momentary contact switches are recognized for their reliability and long life.

All are Underwriters' Laboratories inspected.

**UNCONDITIONALLY GUARANTEED** No. 41 single-pole, single-circuit, universal lever switch 6 amp. "T" 125V—3 amp. 250V. Only  $\frac{5}{8}$ " thick, it is ideal for conduit box and canopy mounting for lighting and FHP motor control.



No. 100 single-pole, 15 amp. 125-250V, 1 HP 120-240V AC, normally "OFF" momentary contact switch. 1 amp., 125V— $\frac{1}{2}$  amp., 250V DC. Especially suitable for limit and safety control of industrial machinery.



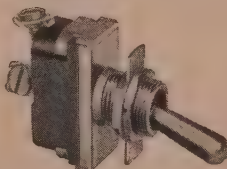
No. 1901. Basic 30 amp. momentary contact switch rated 30 amp. 125 or 250 V AC, 1 HP 125 V—2 HP 250 V AC, 2A 125 V— $\frac{1}{2}$ A 250 V DC. Available SPST NO or NC, SPDT and SPST 2 ckt. with six standard actuators. Size 1.876" x .812" x .500".



No. 71 single-pole, single circuit, universal lever switch . . . the thinnest 6 amp. "T" 125V—3 amp. 250V switch of its kind on the market today—only  $\frac{15}{32}$ " thick. Also with push button.



No. 25 toggle switch carries a 6 amp. "T" 125V, 3 amp., 250V rating with an S.P.S.T. double-break mechanism.  $\frac{1}{3}$  HP AC 120-240V. Ideal for panel board, FHP motors, appliances, power tools, etc.



No. 90  $\frac{3}{4}$  HP capacity, 15 amp. 125V, 10 amp. 250V toggle switch with an S.P.S.T. mechanism. Designed for AC operation. Also carries 20 amp. 125V AC non-inductive load for heater applications. Also available in two circuit with center off and no off. Choice of terminals.

For complete descriptions of the entire McGILL line of switches, sockets, portable lampguards and other electrical specialties, write for catalog No. 84.

AVAILABLE FROM YOUR ELECTRICAL WHOLESALER

*engineered electrical products*

# McGILL



*precision needle roller bearings*

McGILL MANUFACTURING COMPANY, INC., ELECTRICAL DIV., 450 N. CAMPBELL ST., VALPARAISO, INDIANA





THE  
ORIGINAL  
DUAL-GRIP  
ENTRANCE HEADS\*

BY **WEAVER**

LOOK FOR THE PATENT NUMBER—  
YOUR PROTECTION AGAINST COPIES!  
\*U. S. PAT. NO. 2,739,999

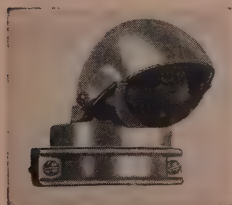
easier to use . . . just tighten the screws

"Dual-Grips" save your customers time and money.

When "Dual-Grips" are used on EMT,  
your customers know they're "on to stay"  
—with no special fittings.

With rigid conduit, the electrician just slips  
the head on and tightens the screws.  
No valuable time wasted cutting threads.

Lightweight aluminum alloy—moistureproof—rust-  
proof. Eight sizes: 1/2" thru 3".



NEW COMBINATION ENTRANCE HEADS  
. . . head and reducer in one compact,  
easily installed unit! No mast threading.  
For 2" or 2 1/2" rigid conduit or pipe.

MR. WHOLESALER: STOCK THESE POPULAR  
HEADS NOW — THEY SELL!



2110 HOWARD ST., ST. LOUIS 6, MO.

telephone GARfield 1-6336

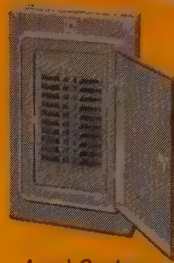




Safety Switches for Normal and Hazardous Locations



Industrial Circuit Breakers for Normal and Hazardous Locations



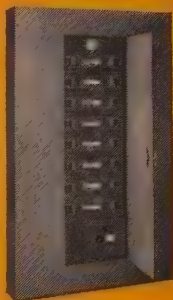
Load Centers—Circuit Breaker and Fusible



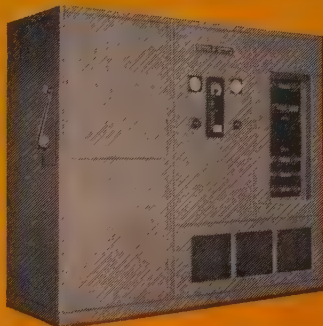
*...design leadership*



*...design*

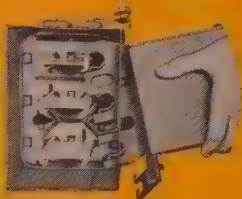


Fusible and Circuit Breaker Lighting and Power Panelboards



Power Distribution Switchboards and Switchgear

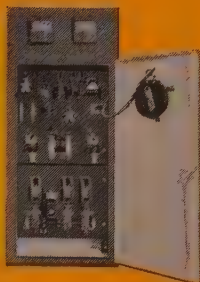
Plug-In Duct



Feed-In Duct



Motor Control Centers



Synchronous Motor Starters



High Voltage Starters

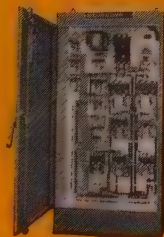
Wireways



### *Field Engineering Service*

is available through more than one hundred Square D offices, backed by an international network of over 1000 authorized electrical distributors and 19 plants in the United States, Canada, Mexico and Great Britain.

*Executive Offices • 6060 Rivard St., Detroit 11, Mich.*



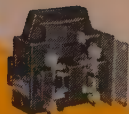
Special-Purpose Control

**SQUARE D COMPANY**





Drum Switches



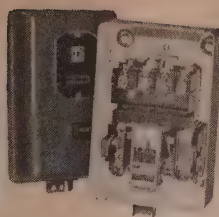
Control Relays



Timing Relays



Manual and Magnetic Starters



A *Complete* LINE  
OF ELECTRICAL  
DISTRIBUTION  
AND CONTROL  
EQUIPMENT

Leadership



...design leadership



Limit Switches



Push Buttons



Combination Starters



Starters for Hazardous Locations



Reduced Voltage Starters



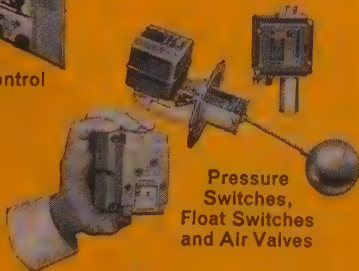
Welder Control



Static Control Components and Systems



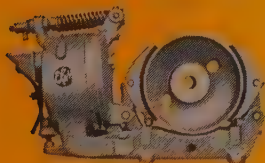
Lifting Magnets



Pressure Switches, Float Switches and Air Valves



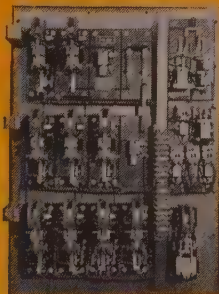
Resistors



Magnetic Brakes



Crane and Mill Control



ADJUSTABLE SPEED DRIVES  
BUSWAYS & WIREWAYS  
CIRCUIT BREAKERS  
CONTROL CENTERS  
CRANE & HOIST CONTROL  
DISTRIBUTION SWITCHBOARDS  
ELECTRIC TRUCK CONTROL  
HIGH VOLTAGE CONTROL  
LAUNDRY CONTROL  
LIFTING MAGNETS  
LIGHTING AND POWER PANELBOARDS  
LIGHTING CONTROL — LOW VOLTAGE  
LIMIT AND FOOT SWITCHES  
MACHINE TOOL CONTROL  
MAGNETIC BRAKES  
METER MOUNTINGS  
MOTOR STARTERS  
PRESS CONTROL  
PRESSURE, FLOAT, & VACUUM SWITCHES  
PUSHBUTTONS  
RELAYS AND CONTACTORS  
RESISTORS  
SAFETY SWITCHES  
SERVICE ENTRANCE EQUIPMENT  
STAGE DIMMERBOARDS  
STEEL MILL CONTROL  
SWITCHGEAR & UNIT SUBSTATIONS  
SYNCHRONOUS MOTOR CONTROL  
TERMINAL BLOCKS  
TEXTILE MACHINE CONTROL  
TIMERS  
VOLTAGE TESTERS  
WELDER CONTROL

wherever electricity is distributed and controlled





There are two main considerations in lighting a drive-in restaurant. 1) Providing enough light for safe movement and parking of a large volume of traffic; 2) Providing a well-lighted area that readily iden-

tifies the drive-in and attracts passing motorists. The above drive-in accomplished this by mounting 3 floodlights and 5 clusterlites on each of 6 poles. Mounting height 33 feet, pole spacing 24 feet.

## Revere matched outdoor lighting equipment means fast, trouble-free installation

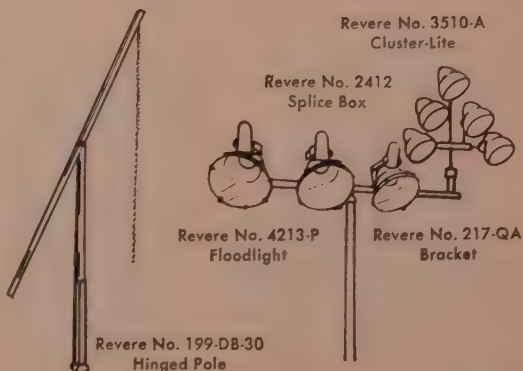
All components for the outdoor lighting installation shown above were made by Revere. All components—hinged poles, brackets, floodlights, cluster-lites and accessories—are made for each other.

By ordering your outdoor lighting from one reliable source, you can be sure that the equipment will fit together right when it gets to the job. This means fast, easy installation and less headaches for you.

You can also be sure that the components are structurally matched for strength and balance, and that they are matched in design for peak lighting efficiency and best appearance. All equipment from one source also means one delivery schedule from one manufacturer—all components reach the job at the same time.

Revere offers you the widest line of outdoor lighting equipment in the industry. No matter what the application, Revere has the equipment to do the job. Write for your copy of the Revere Catalog.

### Revere components used in lighting drive-in restaurant



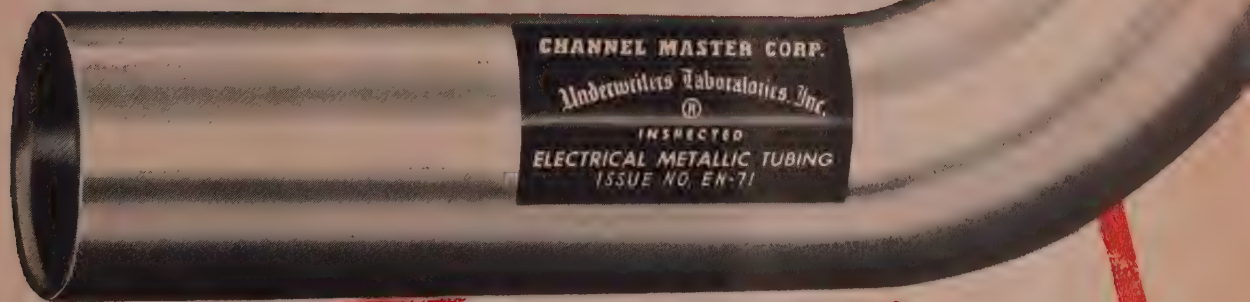
**Revere**  
ELECTRIC MFG. CO.

## OUTDOOR LIGHTING

Revere Electric Mfg. Co. • 7420 Lehigh Avenue • Chicago 48, Illinois (In suburban Niles)  
Long Distance Phone: Niles 7-6060 • Chicago Phone: Spring 4-1200 • Telegrams: WUX Niles  
In Canada: Curtis Lighting, Ltd., Leaside, Toronto, Ontario



# CHANNEL MASTER ALUMINUM EMT



**COSTS LESS  
THAN STEEL!**

Channel Master Aluminum EMT provides the advantages you want. It costs less to buy... looks better longer... speeds up the job!

For a price below that of steel, you can have Channel Master Aluminum EMT, the lightweight tubing that *stays* good looking... mirror bright, mirror smooth... inside and out. Aluminum EMT won't ever show its age.

Packaged in standard 10-foot lengths, chamfered at both ends, it is also easier to cut, bend, and put together. The hard-drawn, seamless raceway facilitates fishing and wire pulling. Standard inside and outside diameters match all U.L. approved EMT fittings.

Channel Master Aluminum EMT can be purchased through your regular distributor. Ask him to show you how to make faster, better installations at lower cost.



**CHANNEL MASTER CORP.**

ELLENVILLE, NEW YORK

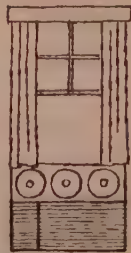


# YOU'RE A KEY MAN IN A VERY BIG PLAN

*General Electric Program to Promote Medallion Homes  
Emphasizes Electric Heating and Cooling*

## **ALL-ELECTRIC HEATING AND COOLING**

Clean, safe, room-by-room comfort control without fuel problems or flues . . . choice of baseboard, wall or embedded wire heating units and room air conditioners for any installation need. For central heating and cooling systems, electric heat pumps.



## **LIGHT FOR LIVING**

Great beauty and true comfort through fluorescent, incandescent, decorative and outdoor lighting. Also important to *total electric living* is TV, radio and hi-fi, which have returned entertainment to the home.



## **GOLD MEDALLION HOMES**

*Equipped by General Electric*

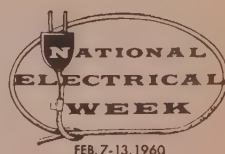


All divisions of the General Electric Company have joined in a concentrated program to increase the planning, building and selling of Medallion Homes equipped with *electric heating and cooling*.

A major consumer advertising program will help create demand nationally. A local-action program will secure added support from architects, builders and utilities to increase sales of homes with electric heating and cooling.

With greater demand for electric heating and cooling, your role in home-building activity will be greatly increased. To help you profit, General Electric, in cooperation with your local utility, has prepared a complete Electric Heating Institute including training films and instruction manuals for all types of electric heat installations. Your utility has probably scheduled this program. Ask them for time and place. P.S. See the General Electric Exhibit at the National Electric House Heating Exposition, Hotel Sherman, Chicago, March 21-23.

Residential Market Development Operation,  
General Electric Company, Appliance Park,  
Louisville 1, Kentucky.



#### **ALL-ELECTRIC KITCHEN-LAUNDRY**

Refrigerator, freezer, washer, dryer, range, dishwasher, Disposall® are a vital part of modern living. Electric water heating eliminates flames and fumes.



#### **FULL HOUSEPOWER**

Ample wiring, switches, controls are the foundation of *total electric living*. Without them no equipment can produce top results and the installation of future equipment can be costly.



*Progress Is Our Most Important Product*

**GENERAL  ELECTRIC**



*Get peak cable  
protection  
at lowest  
dollar cost*

Transite Ducts can be laid directly in trench without concrete envelope. Or if ductbank is to be concrete enclosed—thinner walled Transite Duct may be used. In all other respects both heavy-wall and thin-wall Transite Ducts are identical.



## Transite Ducts save on the job and after!

**No other duct material gives you so many  
installation and in-service economies**

In every way, Transite® Ducts are the most efficient electrical ducts you can install. And—when assembled with J-M's Plastic Coupling—their cost is remarkably low!

One reason for this economy is in installation. Strong, lightweight, long—Transite lengths are easy to handle and install . . . Your men set the ducts in place easily, join them tightly in seconds. Transite's smooth bore is free of burrs and obstructions. Thus, long cable pulls are easily accomplished with no damage to cable sheathing.

You see another reason for Transite's economy in performance. Once in service, Transite's unusually high rate of heat dissipation means cables run cooler, last longer. Transite also confines any damage . . . cannot burn, smoke or fume. It won't generate explosive or toxic gases. If arcing does occur, Transite Ducts won't sag or adhere to cable.

Let us send you the Transite Duct brochure EL-29A. Write Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.

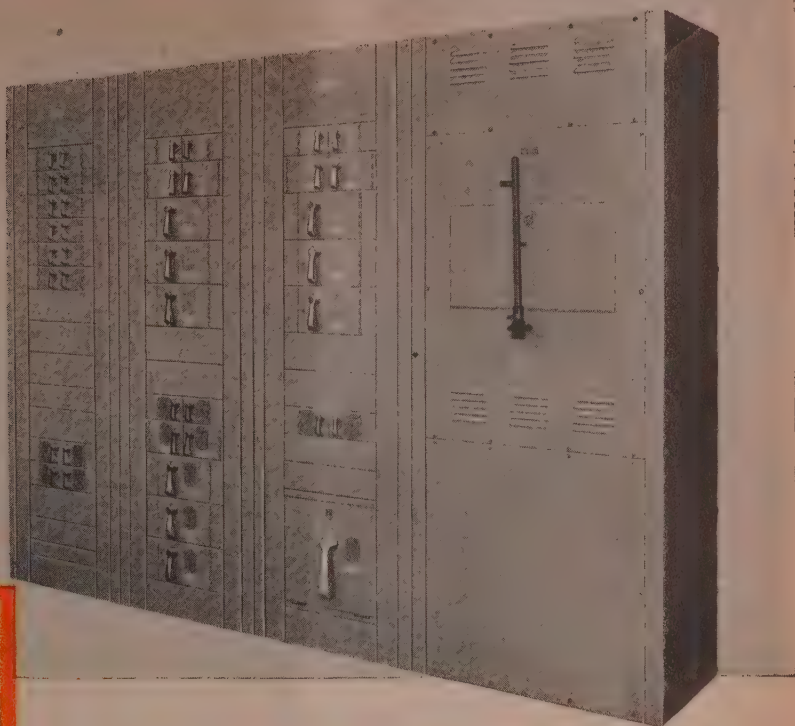


# JOHNS-MANVILLE



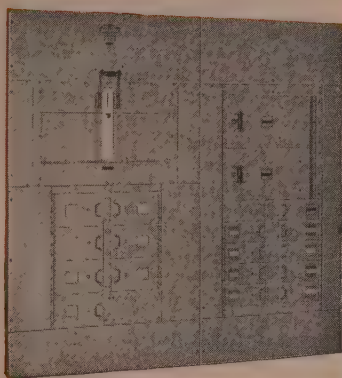


**STANDARDIZED UNITS** for "tailor-made" jobs  
assure quicker delivery, faster and easier installation!



**S-A-W TYPE  
SHUTLARK SWITCHBOARD**

Heavy duty, safety-type  
specially designed for the  
most severe use.



**KLAMP SWITCHFUZ SWITCHBOARD**

Features both disconnect  
and fuse apparatus.



**CIRCUIT BREAKER SWITCHBOARD**

The ultimate in automatic circuit protection.

# FRANK ADAM SWITCHBOARDS

Factory-assembled standardized units—pioneered and developed by Frank Adam—permit installation of "tailor-made" switchboards in far less time for considerably less money. Interchangeable branches can be rearranged to allow for the addition of more protective units as load demands increase.

Easier to install, too! Oversize wiring gutters—accessible from front and back—allow fast and trouble-free installation!

Heavily electro silver-plated copper bars . . . rigid welded frames . . . quicker delivery . . . plus a dozen other outstanding features give you an impressive number of reasons for installing Frank Adam Switchboards.

See our catalog in SWEET'S



**FRANK ADAM ELECTRIC COMPANY**

P. O. BOX 357, MAIN P. O. • ST. LOUIS 66, MO.

busduct • panelboards • switchboards • service equipment • safety switches • load centers • Quikhealer





Mr. Lester Olsen, Electrical Contractor for the  
Random Lake High School, Random Lake, Wis., says:

## "Simplified wiring Clock System



*Mr. Olsen stands beside the Honeywell Master Time and Program unit (ST 401, cover removed).*



# diagrams made the Honeywell a snap to install!"



*Electrical Contractor: Lester Olsen; Olsen Electric of Wisconsin and Florida  
Architect: Edgar A. Stubenrauch and Associates  
Engineer: Trester and Company; Sheboygan and Milwaukee*

**Mr. Olsen found that installing the Honeywell Clock and Programming System at Random Lake High School was easy—thanks to Honeywell's concise, easy-to-follow engineering diagrams.**

"We were pleased with the way Honeywell backs their Clock and Programming System with clear, concise wiring diagrams," says Mr. Olsen. "Our engineers had no installation problems whatsoever, and the entire job proceeded without a hitch."

Mr. Olsen adds: "By periodically checking installation procedures, Honeywell men helped us insure against costly wiring changes or corrections. What's more, we found the job of installing a Honeywell Fire Alarm Sys-

tem went smoothly, too. In fact, the same service and installation ease of the Honeywell Clock and Programming System is true of the Fire Alarm System!"

Mr. Olsen's story can be your story, too. You'll find that Honeywell's on-the-spot efficiency gets the job done quickly and correctly . . . by men *specifically* trained for the job. Why not call your local Honeywell office today? Let them tell you about the quality service that has made Honeywell *first in control* since 1885!

**75** YEARS OF  
PIONEERING THE FUTURE

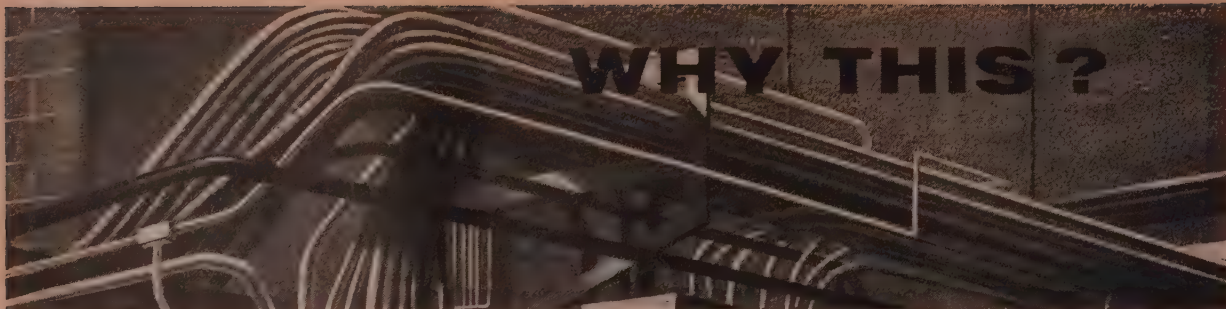
## Honeywell



*First in Control*

SINCE 1885

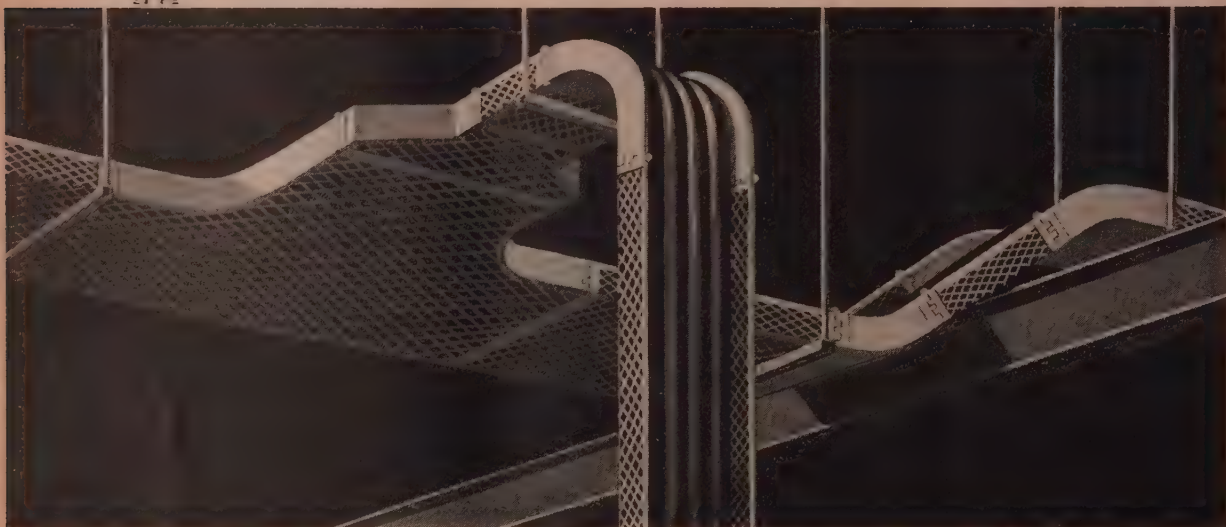




# WHY THIS?



# WHY NOT THIS?



## COPE WIREWAY CABLE SUPPORTING SYSTEMS SAVE "3 WAYS" OVER "TRADITIONAL" MATERIALS

Why pay a premium for your cable supporting equipment—when Cope Wireway offers a *completely integrated system* for much less. Compare these facts for yourself.

- **Lower material cost—**

One section of 24" wide Wireway supports *as many cables* as 16 lengths of 4" conduit—at only 1/10th the weight. That means you're buying much less materials regardless of the size of the job.

- **Less to install—**

Wireway's lightweight and unique coupling method, speeds joining of/straight lengths and fittings—even in close quarters. A Cope system comes *complete* with all necessary accessories—ready to go.

- **Built-in expansibility—**

With Wireway, you need not be concerned about costly re-routing or later additions to your system. Cables are always readily accessible and Cope's pin type couplers can be quickly disconnected to permit change in direction or elevation.

Ask for proof! See your *authorized Cope Electrical Wholesaler* for more information on economical Cope Wireway—in either aluminum or hot dipped galvanized steel. Or write us direct.

1102

# COPE

DIVISION OF ROME CABLE CORPORATION • COLLEGEVILLE, PENNSYLVANIA

Originators of the first integrated line of  
Cable Supporting Systems

• WIREWAY • CHANNEL • LADDER • CONTROLWAY

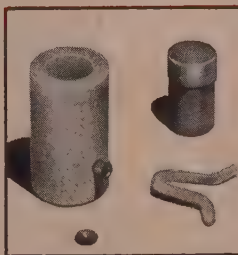
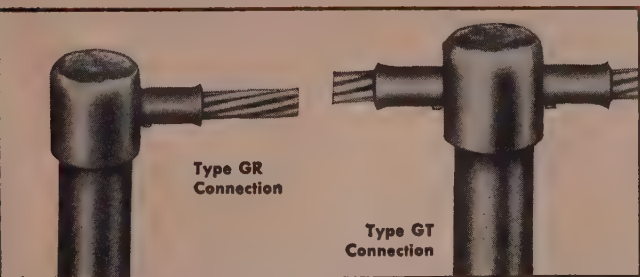
Sold only through authorized electrical wholesalers

# CADWELD ONE-SHOT

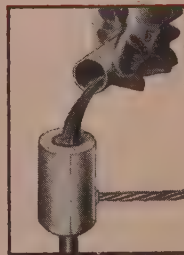
PAT. PEND.

8249 J

World's Simplest and Finest Cable  
to Ground Rod Connections



All parts packed in Mold



Dump Cadweld powder  
in mold



Fire with flint gun

ERICO PRODUCTS, INC., has just introduced a new adaptation of the CADWELD (the original copper thermit principal) PROCESS of electrical connections, the "ONE-SHOT" Mold.

The world's finest permanent electrical connection has now been adapted to a one-time ceramic mold for cable to ground rod connections. Now a simple 3" package contains materials necessary to make the connection that never corrodes or loosens and has a current carrying capacity greater than the conductors.

The "ONE-SHOT" Ground Rod Connections are packed 12 to a box. Each is individually sealed in a polyethylene bag to prevent moisture absorption.

| GROUND ROD | CABLE SIZE                        |
|------------|-----------------------------------|
| 1/2"       | (#4 and smaller) (#2—#3)          |
| 5/8"       | (#4 and smaller) (#2—#3) (1/0—#1) |
| 3/4"       | (#4 and smaller) (#2—#3) (1/0—#1) |

For further information write ONE-SHOT % ERICO PRODUCTS, INC.

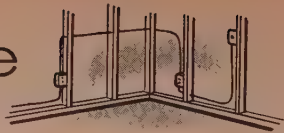
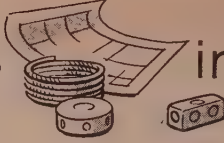
**CADWELD** **Erico Products, Inc.**

2070 E. 61st Place

Cleveland 3, Ohio

IN CANADA: ERICO INCORPORATED, 3571 Dundas St., West, Toronto 9, Ontario



Want a bigger share  of the new  
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Want to be sure you're not missing  good bidding opportunities? Want a

reliable way to size up  jobs...to  
go after the ones that will do you

most good  ? You need daily

Dodge Reports  !!

DODGE REPORTS' are individual building project reports. They're mailed to you daily. You get REPORTS on just the types of building you're interested in—in the area where you do business. They tell who's going to build what and where . . . whom to see . . . when bids are wanted . . . who else is bidding . . . who gets which awards.

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Send me the book: "How Subcontractors Get More Work in New Construction" and let me see some typical Dodge Reports for my area. I am interested in the general markets checked below.

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City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_





**Put**  
**PROVED**  
**dependability**  
**into interior**  
**FIRE ALARM**  
**systems!**

You can provide today's *best* fire alarm protection for any industrial, commercial, or institutional building with a Gamewell FLEXALARM System. Thoroughly pre-engineered by the fire-protection professionals who developed the familiar "pull" fire alarm box, it assures the same unmatched efficiency and dependability *inside* buildings.

Precisely tailored to each installation, FLEXALARM is available as a coded or non-coded system, semi or completely automatic, with practically limitless possible combinations of annunciators, special drill, test, and alarm features. For example, it can be tied into the municipal alarm system at the curb; integrated with the sprinkler system; or automatic fire detection devices.

FLEXALARM is designed for unit-by-unit expansion depending on specific life hazards, fire defense plans and the growth of your plant. It's simple to specify, easy to install, efficient and economical. Gamewell will be happy to assist with fire detection engineering of new construction, expansion, or modernization, if desired. It's a service that gives you the benefit of over 100 years' experience with fire protection systems. Specify Gamewell . . . single source for engineering assistance and complete product line . . . maximum protection at minimum cost. Write THE GAMEWELL COMPANY, 1315 Chestnut St., Dept. 8A, Newton Upper Falls 64, Mass.



**Gamewell**  
FIRST...WHEN SECONDS COUNT



# Chem Marine

TRADEMARK



## RUGGED WIRING DEVICES

Made from special materials that resist corrosive moisture, oil, grease, brine and most acids.

### "INSULPRENE"

—a DuPont neoprene compound.

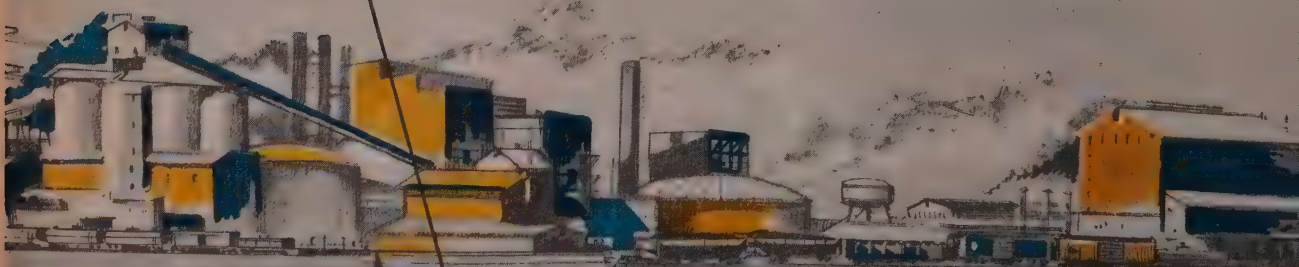
### "MONEL® METAL"

—Reg. Trademark of INCO.

### "MELAMINE"

"CYMEL®" —Reg. Trademark of Am Cyanamid

**HEAVY NICKEL-PLATED  
CURRENT CARRYING PARTS.**



# RESISTS CORROSION

A COMPLETE NEW LINE OF EXCEPTIONALLY RUGGED WIRING DEVICES  
THAT RESIST CORROSION AND CHEMICAL ACTION



**52CM62**

3-wire, 15 amp., 125 volt  
"Melamine" Duplex  
Grounding Receptacle



**52CM11**

Weatherproof Lift Cover Plate  
for duplex receptacles  
used with FS boxes —  
No. 5210 with standard boxes.



**52CM67**

3-wire, 15 amp., 125 volt  
Grounding Cap

**74CM20**

Metal Weatherproof  
Lift Cover Plate  
with heavy vinyl  
coating for single  
receptacles. Shown with  
73CM10 "Twist-Lock"  
Receptacle and  
mounted to  
standard FS box.



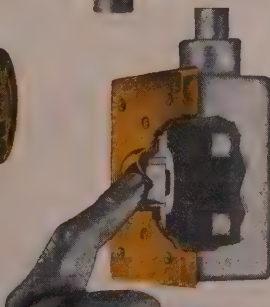
**99CM60**

Shown with  
"Insulprene"  
"Seal-Tite"  
Cover 75CM31



**99CM66**

3-wire, 20 amp.  
"Insulprene"  
"Twist-Lock"  
Connector Body



**17CM51**

Weatherproof  
"Insulprene" Plate  
and A.C. "Presswitch"  
Combination.

Listed by: Underwriters'  
Laboratories, Inc.

One of industry's most extravagant expenditures is for the replacement of wiring devices which have been eaten away by corrosion. This year-round menace to life and property causes ordinary wiring devices to deteriorate to a dangerous degree in just a few months, causing power failures, accidents and down-time. Replacement costs run in the millions.

To guard against these evils, Harvey Hubbell, Incorporated is introducing their new line of "Chem Marine", weather-resistant wiring devices engineered to withstand corrosive elements including moisture, oil, grease, brine and most acids. They are constructed throughout from corrosion-resistant materials which insure extra wiring dependability and safety, plus tremendous savings in maintenance and replacement.

"Chem Marine" devices are identified by their bright yellow color. Those shown, at left, are representative of the complete line and other units may be added by talking with Hubbell engineers. If you have questions as to the suitability of "Chem Marine" units for special industrial or chemical applications, simply contact the "Chem Marine" Department, Harvey Hubbell, Incorporated, Bridgeport 2, Connecticut.

## AREAS OF APPLICATION

LAUNDRIES CHEMICAL COMPANIES PLATING ROOMS  
PAPER MILLS MILK PLANTS MEAT PACKING PLANTS  
SHIP YARDS WAREHOUSES SHIPPING PLATFORMS  
LEATHER TANNING INDUSTRY AUTOMOTIVE INDUSTRY



**HARVEY  
HUBBELL,  
INCORPORATED**

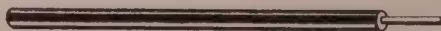
BRIDGEPORT 2, CONNECTICUT  
In Canada: Scarborough, Ontario



# B.F. Goodrich Chemical *raw materials*

HOW  
TO  
GET  
BETTER INSULATION  
FOR

# TELEPHONE DISTRIBUTION WIRE



## INSIST ON GEON 8803

Bell, REA and other independent testing organizations agree on the high quality of insulation you get when conductors are insulated with Geon polyvinyl material.

Geon provides superior electrical properties, as well as excellent resistance to abrasion and weathering. Even total immersion in water or oil for years can't break down Geon materials.

In addition, wires insulated with Geon can cut hook-up costs as much as 50%. Since this insulating material can easily be color-coded, it is easy for installers to tap into the right line anywhere along the system.

Insulating distribution wire is only one of the many places where Geon

provides superior service for the electrical and telephone industry. Geon also provides excellent pipe, conduit and coatings for many products. For more information about Geon 8803 or any of the many forms in which Geon can be used, write Dept. GY-1, B.F. Goodrich Chemical Company, 3135 Euclid Ave., Cleveland 15, Ohio. Cable: Goodchemco. In Canada: Kitchener, Ontario.



**B.F. Goodrich Chemical Company**  
a division of The B.F. Goodrich Company



GEON vinyls • HYCAR rubber and latex • GOOD-RITE chemicals and plasticizers

... Aluminum Troffers for POWER-GROOVE . . .

## COMFORTABLE, High Footcandle Lighting at LOWER COST than Ever Before Possible

Another Lighting First . . . Miller has just broken through some long standing cost barriers to COMFORTABLE, high footcandle lighting for Offices, Stores, and Public Buildings. Now, you can obtain or provide today's needed higher levels of light at *much* lower cost.

*For Example . . .* The lighting installation pictured is designed to maintain 120 footcandles in this 60' x 80' general office area. Fixtures are Miller's new Twin Aluminum Troffers—2' x 8' units with Power Groove Lamps. Compared with conventional, 2' x 4' door type recessed systems using 40w Rapid Start Lamps, and providing comparable footcandles and comfort; this new Power Groove system requires only  $\frac{1}{4}$  as many fixtures, and has an initial installed cost 30%-38% lower. Annual Owning and Operating cost figures 14%-18% less. And, fewer fixtures needed means a less cluttered, more pleasing ceiling appearance. Here, 34% more ceiling area is available for acoustical treatments.

Substantial savings can be realized for both relighting and new construction . . . wherever comfortable, high footcandle lighting is desired. Let us prove to you how such savings are possible for this and other typical installations. Simply fill out and mail the coupon. Or, contact your Miller Representative.



SINGLE ALUMINUM TROFFER



TWIN ALUMINUM TROFFER



MAIL TODAY

To: Dept. A-260  
THE MILLER COMPANY, Meriden, Conn.

- ☐ I'd like additional information on how I can obtain comfortable, high footcandle lighting at lower cost with Miller Aluminum Troffers.
- ☐ Have Your Field Representative contact me.

Name \_\_\_\_\_ Position \_\_\_\_\_

Company \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

LIGHTING BY

**miller**  
SINCE 1844



THE **miller** COMPANY

MERIDEN, CONNECTICUT



# Westinghouse develops new motor starters

with

## "monkey proof" safety features

*Westinghouse NEMA 12 Life-Line combination starters end unauthorized tampering, offer greater safety and convenience to service personnel*

To order simply contact your local Westinghouse representative or distributor now, or write Westinghouse Electric Corporation, Standard Control Division, Beaver, Pa.

**YOU CAN BE SURE...IF IT'S** **Westinghouse**

Watch "Westinghouse Lucille Ball-Desi Arnaz Shows" CBS TV

Check these  
6 great new  
safety "firsts"...

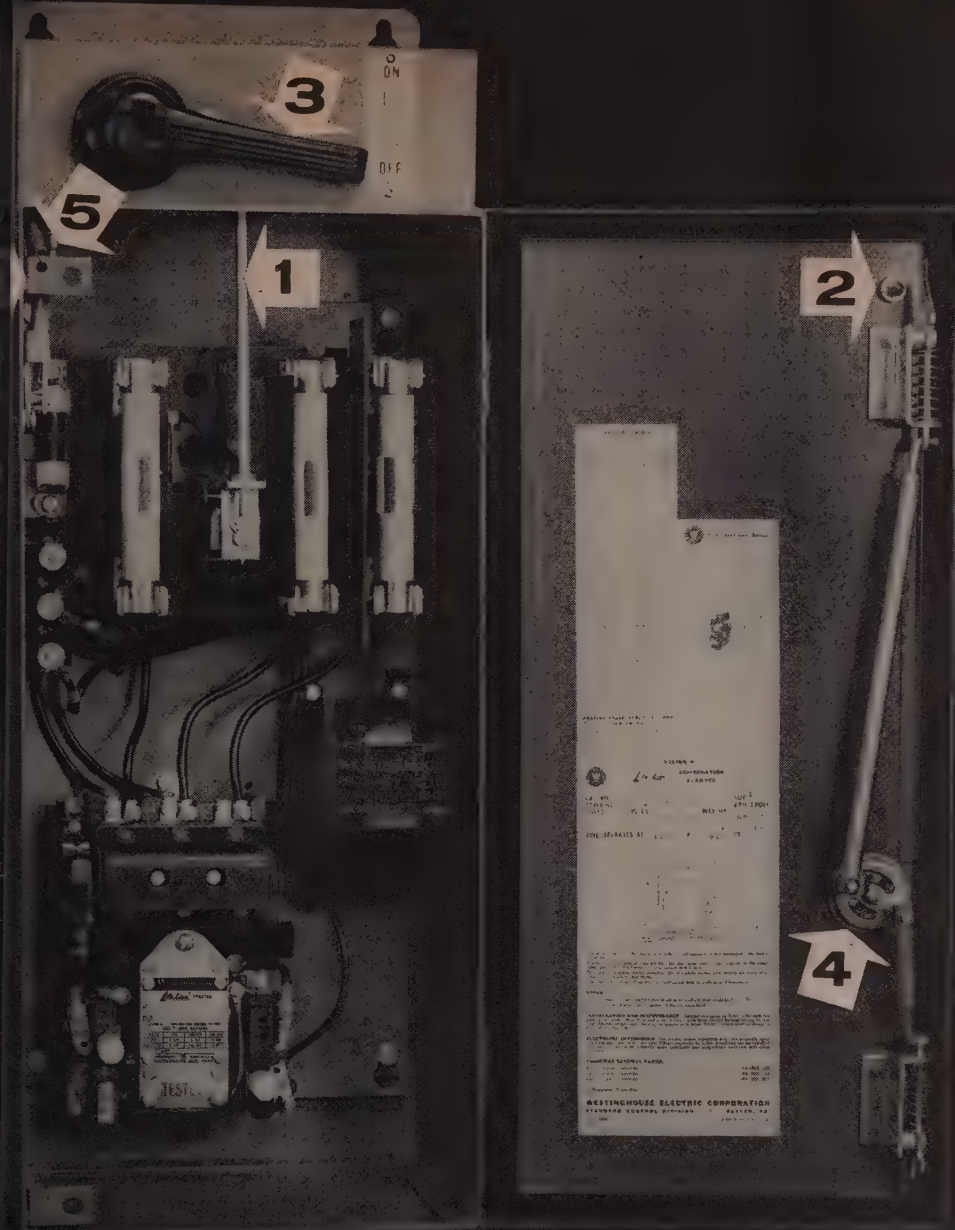
**SAFE**—You always know whether power is on or off because ON-OFF handle is permanently attached to disconnect... even when door is open.

**SAFE**—Positive gasket seal keeps out oil and dust. An interlock requires that door must be tightly sealed before handle can be moved to ON position.

**SAFE**—Even when you're out of sight, padlocking ON-OFF handle prevents any operation of disconnect regardless of whether door is **OPEN** or **CLOSED**.

# 123





# 456

**SAFE**—Discourages tampering by unauthorized personnel. Tool required to open door.

**SAFE**—Accidental operation of disconnect impossible when door is open. Disconnect interlock must be deliberately voided to operate ON-OFF handle.

**SAFE**—Interlock prevents door from being opened when switch is on. ON-OFF handle must be in OFF position to open door.

J-30306





## OIL:

another ex-enemy of portable cord... thanks to neoprene jacketing

Ordinary rubber swells like an infected thumb if you let it soak in oil. *Unseen* deterioration of the rubber is even worse. Oil absorption causes progressive loss of tensile strength, elasticity, durability.

Portable cords in industrial service frequently are exposed to oil and grease. Such treatment drastically shortens effective service life... but not if cords are made with oil-resistant neoprene jackets.

Neoprene jacketing helps keep cords on the job longer... serves as an insurance measure against costly interruptions of electrical service. Neoprene resists oils, greases, chemicals... stays tough and resilient at both high and

low temperatures... shrugs off the effects of ozone and aging. No other jacketing material has such a versatile combination of properties. No other jacketing material has been so thoroughly proven in actual service. E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Department EC-2, Wilmington 98, Delaware.



**NEOPRENE**

Better Things for Better Living... through Chemistry





### Red Throat

BM-21B  
1/2" Connector  
BM-22B  
3/4" Connector  
BM-23B  
1" Connector



BM-41  
1/2" Coupling  
BM-42  
3/4" Coupling  
BM-43  
1" Coupling



BM-51  
1/2" Offset Connector  
BM-52  
3/4" Offset Connector



BM Offset  
Connectors  
showing how  
wires are  
guided over  
box edge.

# SAVE IN SIXTY

Save time and money with

## B-M ORIGINAL INDENTER FITTINGS

Here is the combination that is unbeatable when it comes to easier E.M.T. installation at less cost. New lightweight plier size indenters make setting up thin wall conduit a breeze. B-M fittings are neater too! No unsightly nuts or projecting set screws.

A few more of the plus features of B-M fittings are Concrete tight—Vibration resistant—Extra heavy bright zinc plate, salt spray and acid drip tested for corrosion resistance—Extra heavy positive bonding locknuts—smooth rounded edges or bushed throat type connectors that prevent insulation damage—All steel construction with extra heavy gauge wall thickness.



### ALL BRIEGEL FITTINGS ARE U.L. APPROVED AS CONCRETE-TIGHT

When setting E.M.T. in concrete you can make each job easier and more profitable by using Briegel All Steel Indenter Fittings that have UL approval as Concrete-Tight. Contractors everywhere recognize their cost cutting qualities and the fact that they make each wiring job a better job. It is only natural that Briegel Fittings are the most widely used E.M.T. connectors and couplings.

### BM PLIER SIZE INDENTERS

BM—No. 607 1/2"  
BM—No. 608 3/4"  
BM—No. 609 1"

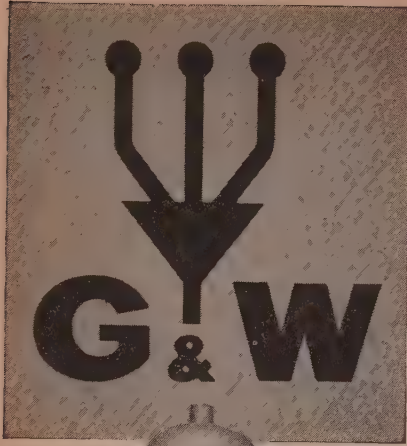


All B-M indenter type fittings far exceed the requirements of U. L. file card E 10863 and Federal Specifications W-F-406.

**BRIEGEL** METHOD  
TOOL  
CO.  
GALVA • ILLINOIS

USED THE MOST FROM COAST TO COAST





# POTHEADS

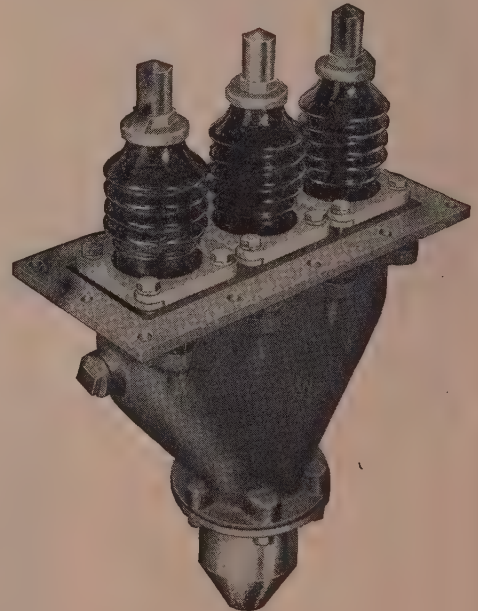
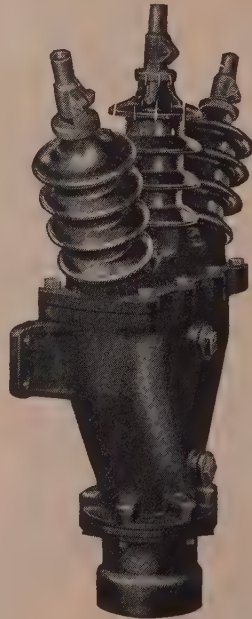
## A DESIGN FOR EVERY CABLE

Only G&W can supply a complete pothead line—extra high voltage, capnut, soldered porcelain or disconnect—230,000 to 600 volts. High, medium and low pressure. Compound, oil and gas filled. Outdoor, indoor and for equipment mounting.

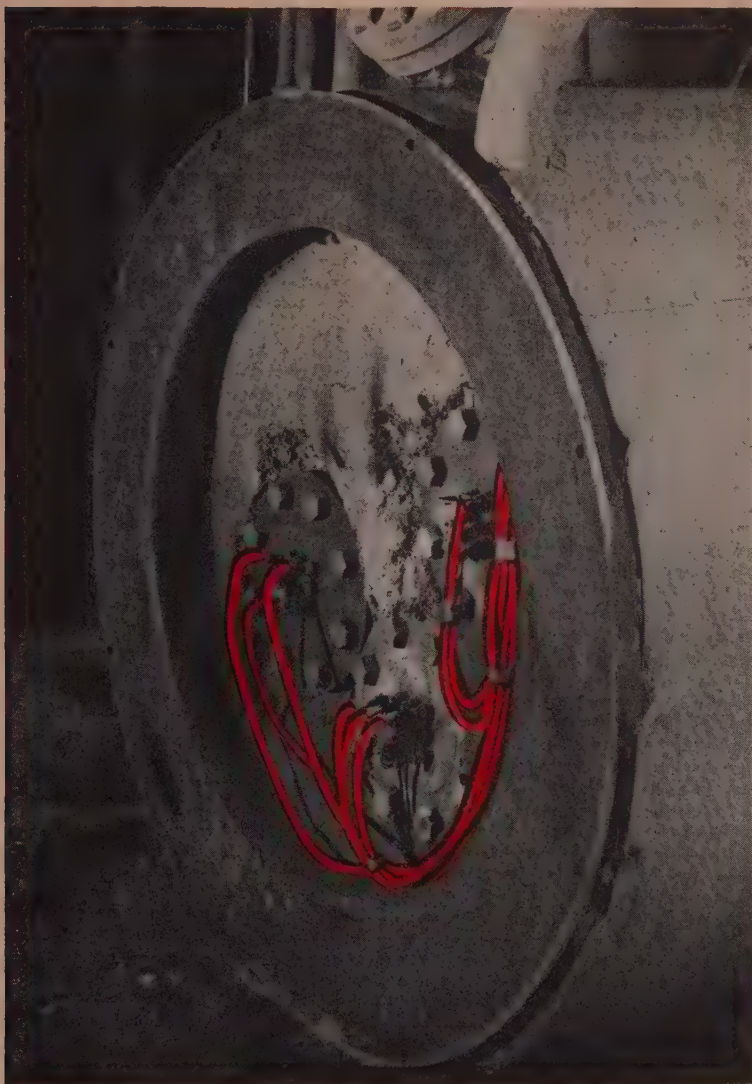
Specify G&W potheads for your cable terminations to be sure that potheads are available for every application.

**G&W ELECTRIC SPECIALTY CO.**

3500 WEST 127TH ST. • BLUE ISLAND, ILL.



# Use One Wire Throughout



effects of ozone often present near electrical equipment. Add all these advantages together and they spell economy, long service, freedom from maintenance. You can use wire covered with Silastic throughout a whole plant, rather than specifying a dozen different specialty wires.

Shown are a few of the areas where lead wire insulated with Silastic is currently being used: on boiler heating coils, motors, outdoor signs. Most leading manufacturers now offer power cable, control cable, hook-up wire, fixture wire, and building wire with insulation of Silastic. These latter two, of course, meet accepted UL standards.



**SILASTIC<sup>®</sup>** gives sure protection  
**SILICONE RUBBER** in any installation

The beauty of this wire is that you can use it practically anywhere. Because it's insulated with Silastic, the Dow Corning silicone rubber, and Silastic is amazingly versatile. It can take heat up to 500 F. It can take outdoor weathering indefinitely. It's highly flexible, and allows wire to be soldered with ease by gun or dip method because it won't shrink or peel under heat. Should a sudden surge of power overheat the wire, Silastic will keep right on insulating. Also, Silastic resists the damaging

Why not get the details on the benefits of this exceptional insulation? For a list of wire and cable suppliers and further information, write Dow Corning, Dept. 3902, or contact the Dow Corning office nearest you.

If you consider *all* the  
properties of a silicone rubber, you'll  
specify Silastic.



**Dow Corning CORPORATION**  
MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.





# The Splice is always right



## U. S. GRAY PERFECTION TAPE

Made of the strongest fabric, impregnated in every fiber with pure rubber. This U.S. Rubber method of manufacturing eliminates pinholes. The tape has the strongest adhesion. U. S. Gray Perfection Tape will not dry out. Here is a tape that not only meets specifications, but exceeds them.

United States Rubber produces tape for every insulation and splicing need. "U.S." engineers know exactly what is required of any splicing compound, whatever the application. Simplify your purchasing by ordering from *one* line — the "U.S." line. Get in touch with any of our numerous distributors or one of our strategically located Branch Sales Offices, or write to address below.



## USCO SPlicing COMPOUND

High dielectric resistance makes it especially suitable for high voltage work on railroads, power lines and signal lines. Usco is waterproof and always durable.

# ...and so is the price!



#### USKORONA® SPLICING COMPOUND

This is the ozone- and moisture-resistant tape for overhead splicing where high dielectric protection is needed. Uskorona fuses quickly without heat or pressure and makes the splice an inseparable part of the original insulation. Uskorona is superior in tensile strength, durability and moisture absorption. Use the time-proven Uskorona splicing compound—and be sure.

When you think of rubber, think of your "U. S." Distributor. He's your best on-the-spot source of technical aid, quick delivery and quality industrial rubber products.

Mechanical Goods Division

## United States Rubber

WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

Rockefeller Center, New York 20, N.Y.

In Canada: Dominion Rubber Company, Ltd.



# NEW! O.Z. PULL-N-SPLICE BOXES! CONVENIENT·COMPACT·ECONOMICAL

**Exclusive moisture-, fungus-,  
corrosion-resistant features!**

**FOR VOLTAGES TO 600 v.**

GREATER  
CLEARANCES TO  
GROUND AND BETWEEN  
CONNECTORS

ONE-PIECE  
CONNECTORS  
FOR LOWEST  
RESISTANCE

TYPE "YCE"—  
EXPLOSION-PROOF

NO  
NEED FOR  
BARRIERS

TYPE "YCW"—WEATHERPROOF

O.Z. Pull-n-Splice Boxes mark a significant advance in pull box construction!

Their highly compact size saves more space than ever!

Their more efficient design means new savings in installation time and labor!

Their moisture-, fungus-, and corrosion-resistant features mean long, trouble-free service.

Still, with all their features, the new O.Z. Pull-n-Splice Boxes are smaller — and cost far less than conventional pull boxes ... even late model competitive types! And, you get a bonus in high quality materials and workmanship so characteristic of all O.Z. products!

For complete information on these and the many other O.Z. products that mean more for you, call your local O.Z. distributor, or write to the company.

**FOR VOLTAGES  
TO 5000 v.**

Type "YPW" — Weatherproof

Type "YPE" — Explosion-proof

Deeper dome than "YCW" and "YCE". Furnished without connector panels. Insulated pigtail splices recommended.

- CAST IRON BOXES
- CABLE TERMINATORS
- POWER CONNECTORS
- SOLDERLESS CONNECTORS
- GROUNDING DEVICES
- CONDUIT FITTINGS
- INTERLOCKED ARMOR CABLE FITTINGS



# O.Z.

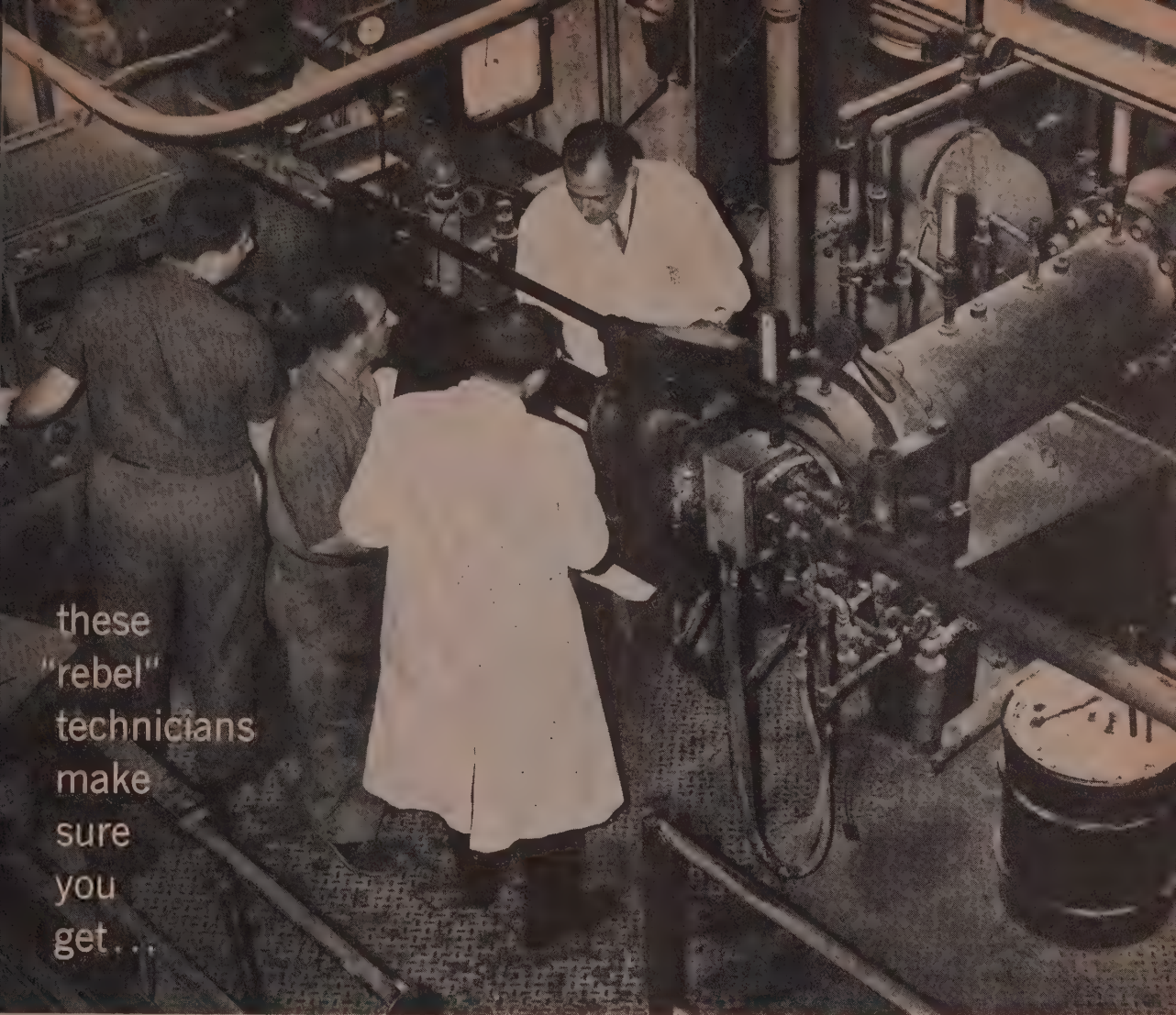
**ELECTRICAL MANUFACTURING CO., INC.**

**262 BOND STREET • BROOKLYN 17, N. Y.**

Sales Office and Warehouse: 406 So. Cicero Avenue, Chicago 44, Ill. • Esterbrook 9-0326  
Office and Factory: 749 Bryant Street, San Francisco 7, Calif. • Garfield 1-7846







these  
"rebel"  
technicians  
make  
sure  
you  
get...

## **"LABORATORY QUALITY" ON PRODUCTION LINE CABLE**

Circle lab men are different. They like to get out in the plant.

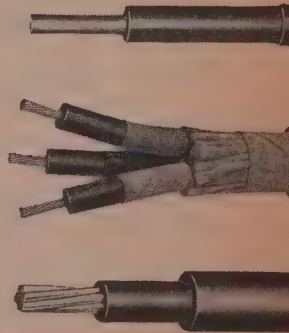
**Reason:** to make sure that the quality they build into a cable in the lab—is all there in the cable you buy.

That's why you'll often find them in the plant working closely with men from process control, inspection and testing. In the photo above, for example, two Circle lab men help check extruder pressure and temperature

for a special butyl compound developed for high voltage power cable.

Such close cooperation between laboratory and quality control personnel is unusual in the wire and cable field. It is another reason, however, why Circle products have grown to enjoy their reputation for high quality.

Next time you buy or specify cable, we suggest you ask for Circle. There's no finer cable made.



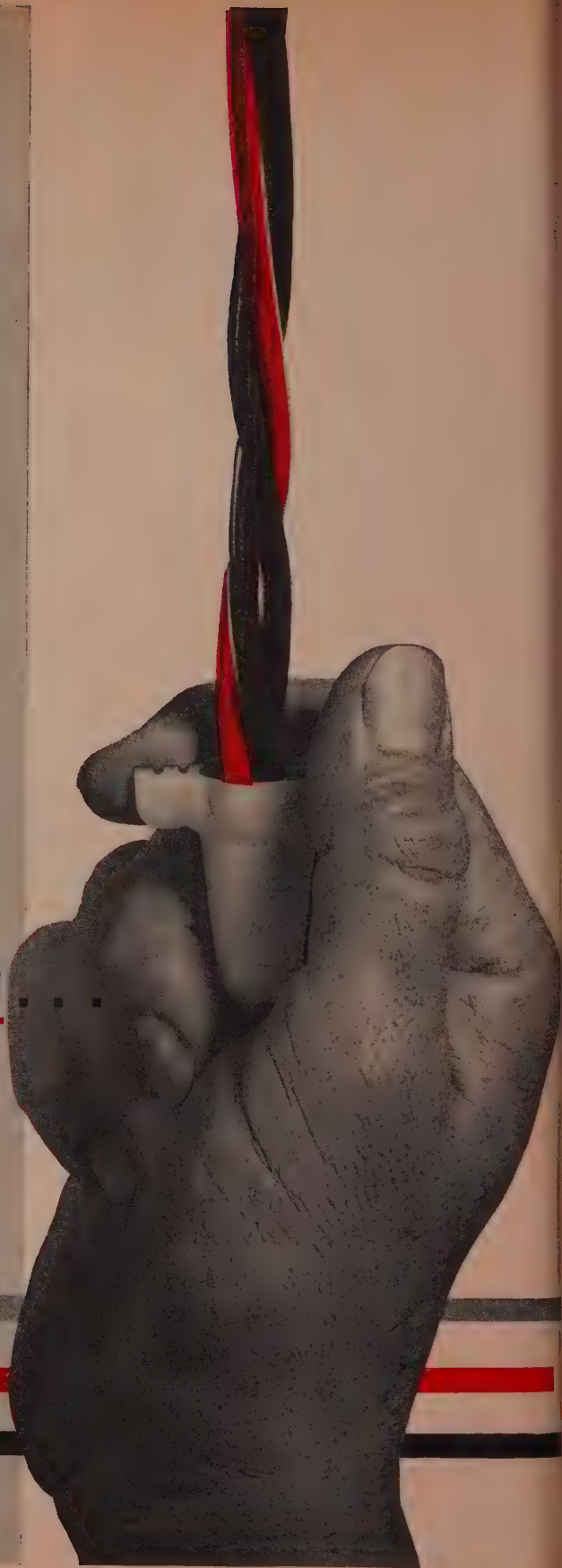
# **CIRCLE**

**WIRE & CABLE**  
a subsidiary of  
**CERRO DE PASCO CORPORATION**



**What?**  
Splicing a  
branch circuit  
**without tools?**

**YES!**  
because only  
**WING-NUT**  
has a built-in wrench . . .



*For the tools and supplies you need  
on every wiring job, get the finest*

MADE BY **IDEAL**



This one really has it! Here's the *only* one-piece screw-on wire connector with the unique wing grip. Good news for thumb-sore electricians . . . just twist Wing-Nut easily and quickly on even the toughest branch circuit wires, like stiff vinyl-insulated #6. It's so easy, no tools are needed. And in crowded boxes apply Wing-Nut, then snip off the wings.

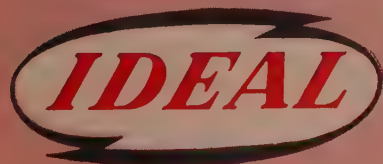
Perfect splice? You *know* it! Your splice is always visible—no take-apart for inspection. You can actually see your splice is right, through the semi-transparent Nylon insulating shell. And that Nylon shell is tough, unbreakable, high-dielectric, and stable . . . won't cold-flow and short-out by stretching thin under strain or pressure.

Only Wing-Nut has a Nylon shell with such a deep, wide skirt. Easily slips over two No. 8 and a No. 6, even thick Type RW. No flash-over. Two sizes of Wing-Nut handle all your needs.

*Aluminum wire, too!* U.L. has approved Wing-Nut for use as a pressure cable (600v) and fixture splicing connector for all possible combinations of standard aluminum-to-aluminum wire splices. And only Wing-Nut is also approved for 474 combinations of solid and/or stranded copper wire.

Sound good? Then see and try the new Wing-Nut yourself.

WRITE FOR FREE SAMPLE



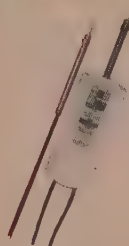
#### NEW—FOR ALUMINUM CONDUIT

"FLEXI-STRAND", Ideal's new extra-flexible fish tape answers the problems of pulling wires through aluminum. It is made of high quality preformed galvanized aircraft cable. It is more durable, and stronger, and will far out-last ordinary flat tapes. So flexible it will easily take sharp bends in aluminum without cutting. Takes extreme flexing without kinking or taking a set. Extremely high breaking point of 2,500 lbs.



#### "WIRE-LUBE" FOR EASIER WIRE PULLING

Easily applied by hand or brush to any rubber, or plastic-covered wire or cable, as they are being pulled into conduit. Wire-Lube protects insulation against breaks, scrapes and strains. Slides wires around bends and thru tight spots. Dries to a fine lubricating powder that makes it easy to add or remove wires later. Noncorrosive, noncombustible, absolutely harmless to hands and clothes.



#### SUPER-SAFE VOLTAGE TESTER

Safest, easiest-to-use voltage tester made. Designed for rugged daily use. Case is seamless plastic in Safety Yellow, with no surface metal. Prods have extra-safe no-slip grips and 30" neoprene leads. Case has center mount for one prod, with prod storage space to completely shield tips. Test for: VOLTAGE (110 to 550v AC; 110 to 600v DC) FREQUENCY (25 to 60 cycles), AC or DC. Solenoid calibrated voltage indicator functions separately from neon test lamp for super-safety. Available with special current-limiting resistors in each prod.



#### "E-Z" AUTOMATIC HAND STRIPPER

Strips standard branch circuit, fixture and lamp wire, and all other stranded or solid wire. Automatic stop locks jaws open after stripping until wire is removed. Eliminates crushed wire ends. Available with eccentric adjustment on blades to limit cutting depth.



#### "T-5" LOW COST STRIPPER

A handy addition to every electrician's tool kit. Strips No. 10, 12, 14, 16 and 18 gauge wires quickly, cleanly, easily. Cuts and loops wire. Sturdy, compact, constructed of hardened steel for rugged duty and long service. Comfortable plastic grips for sure handling and safety. Overall size, 6". Flat design fits easily into pocket or tool kit.

"SOLD THROUGH AMERICA'S LEADING DISTRIBUTORS"

In Canada: Irving Smith, Ltd., Montreal

IDEAL INDUSTRIES, Inc.,  
1041-B Park Avenue, Sycamore, Illinois



Yes! I want the full story on the new Wing-Nut, and my free sample to try on the toughest branch circuit splice I can find. Also send me information on the full line of IDEAL connectors, tools and supplies.

THE HELPING HAND  
ON EVERY  
WIRING JOB

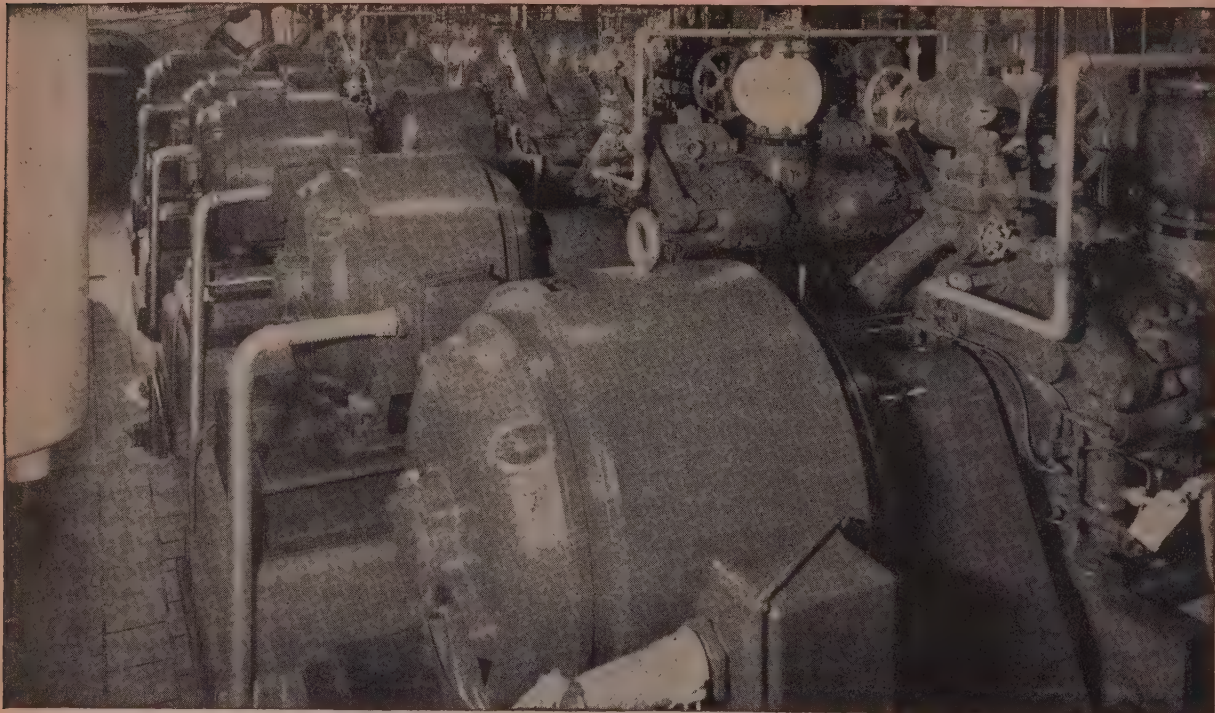
Name \_\_\_\_\_

Firm \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_





## **End Voltage Drop and Line Disturbance Problems caused by starting *BIG MOTORS*...**

### **Use Wagner Increment Motor-Starter Combinations**

Increment starting is the easy, inexpensive way to limit the inrush of starting current in motors up to 500 horsepower. And, you do it *best* with Wagner Increment Motor-Starter Combinations... polyphase open-type, totally-enclosed, or explosion-proof motors and magnetic increment starters.

Line disturbances are reduced because current taken from the line is not broken during the starting period. Motors start sure and fast... reach full speed in a matter of seconds. And... Wagner combinations cost less than motors with primary resistance or auto-transformer type starters.

*Two more plusses:* The compact, relatively lightweight starter is easy to connect... needs very little attention. The motor requires only regular inspection, cleaning, and lubrication... maintenance is minimized.

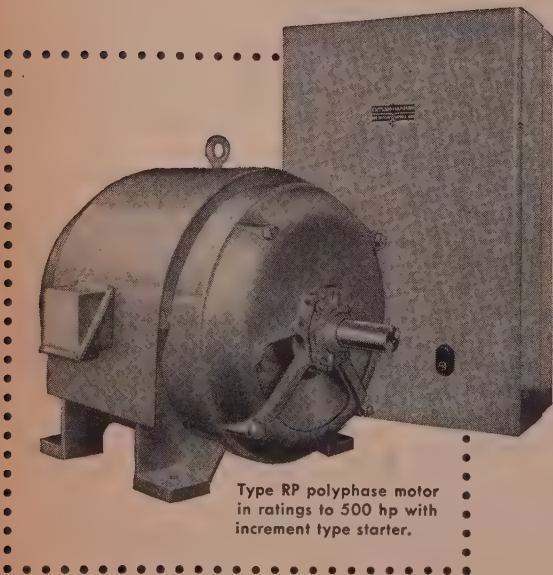
While 2-step combinations are suitable for most applications... 3, 4, 5, or 6-step increment motor-starter combinations are available for installations where unusually low inrush of starting current is required. All meet the polyphase motor-starting requirements of AEIC-EEI-NEMA.

It's possible you can save money on your big jobs with Wagner Increment Motor-Starter Combinations. A Wagner Sales Engineer will help you. Call the nearest Wagner branch or write us for Bulletins MU-128 and MU-195.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

**Wagner Electric Corporation**

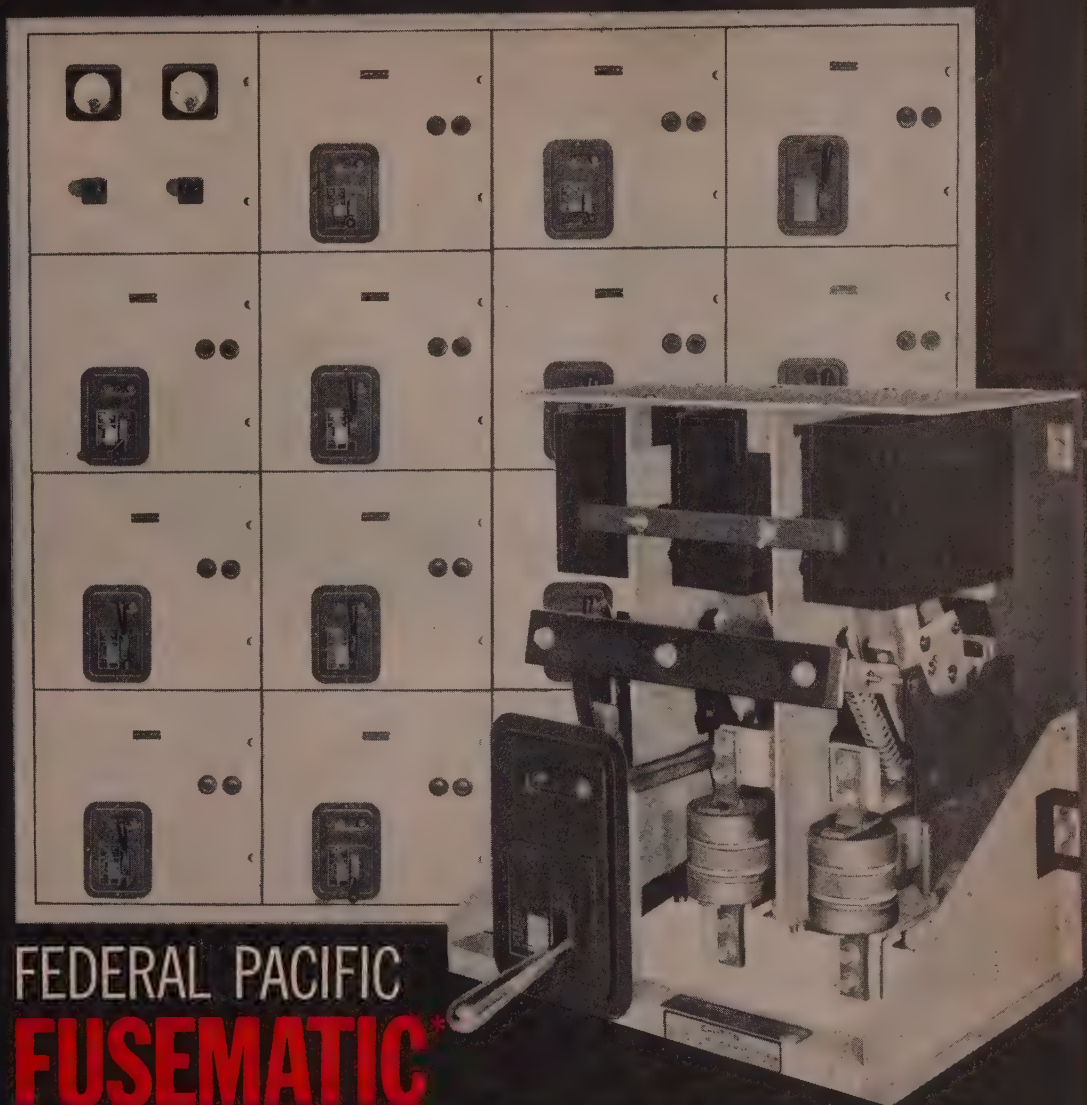
6413 PLYMOUTH AVENUE, ST. LOUIS 33, MISSOURI



Type RP polyphase motor  
in ratings to 500 hp with  
increment type starter.



Another Engineering Achievement



## FEDERAL PACIFIC **FUSEMATIC**

A NEW CONCEPT IN RELIABLE LOW COST CIRCUIT PROTECTION

Now 200,000 amp interrupting capacity breaker at low cost! Fusematic combines a low voltage power circuit breaker with coordinated current limiting fuses in an integral unit. This combination gives you a 600 volt, 1600 ampere breaker with 200,000 amp interrupting capacity. Lower fault current and faster interruption mean improved short circuit protection plus reduced maintenance expenses at substantially lower initial cost.

**SAFE.** Can close against faults up to 200,000 a.

**ECONOMICAL.** Current limiting fuses reduce possible fault current permitting use of smaller frame size circuit breakers.

**COMPACT.** Only 24" wide by 22½" high. Units stack four high in 90" enclosure.

**VERSATILE.** Available in manual or electrical operation, fixed or drawout mountings for both indoor or outdoor construction.

**PROVIDES SINGLE PHASE PROTECTION.**

Get the full details of FUSEMATIC features and economies. Write for Bulletin 6020, Federal Pacific Electric Company, General Offices: Dept. 409, Newark 1, New Jersey—**The Best in Electrical Control, Distribution and Power Equipment.**

\*Trademark



**FEDERAL PACIFIC ELECTRIC COMPANY**

Affiliated with Cornell-Dubilier Electric Corporation



*Electricity  
sparks  
the 60's*

# Republic ELECTRUNIT<sup>®</sup> ELECTRICAL METALLIC TUBING



**GALVITE<sup>®</sup> RIGID STEEL CONDUIT** (Blue Label) is a heavy wall galvanized conduit with a special coat of baked-on lacquer inside and out for greater corrosion-resistance and long life.



**ENAMELITE<sup>®</sup> RIGID STEEL CONDUIT** (Red Label) heavy wall conduit is protected inside and out with a baked-on coating of tough, wear-resistant enamel for greater protection against moderate corrosive action.



**REPUBLIC "DEKORON"<sup>®</sup>-COATED<sup>®</sup> E.M.T.** is the plastic armored raceway recommended for use in severe corrosive conditions of service. Outlasts standard conduit 10-to-1. Easy to install, requires no special tools, no special fittings.



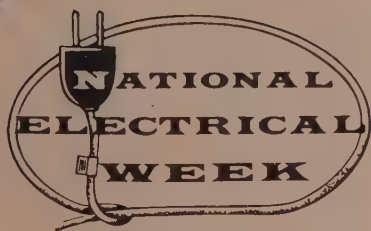
**"DEKORON"-COATED<sup>®</sup> RIGID STEEL CONDUIT** is the heavy wall raceway that shrugs off corrosion. Tough coating of polyethylene encases Galvite Rigid Steel Conduit in an end-to-end armor for protection in severe corrosive conditions of service.



**REPUBLIC BENDING TOOLS** are designed and engineered to help the contractor make accurate predetermined bends in Republic raceway installations. Avoid costly "wows", wasted time, and wasted material. Send for The Bending System Booklet.



*sparks the 70's and 80's too*



**FEBRUARY 7-13, 1960**

**REPUBLIC ELECTRUNITE® E.M.T.** is lightweight, easy to handle. "INCH-MARKED"® in feet and inches for easier, accurate measuring. Full length "GUIDE-LINES"® keep bends in the correct plane. Exclusive "INSIDE-KNURLING" with new Silverslick inside finish makes wire pulling up to 37% easier, wire pushing easier, too.

Big boom building. Lots of work all through the '60's. And, lots of competition. Now is the time to move out ahead. To plan for the profit jobs. Check the story of "The *Best Costs Less Installed*," and the products which produce results. Republic **ELECTRUNITE® E.M.T.** and Rigid Steel Conduit are quality engineered for easier installation.

Republic is building increased E.M.T. capacity now to meet your 1960 needs. Trust Republic products to spark your business all through the '60's . . . and build for profitable '70's and '80's, too. Prove to yourself that "The *Best Costs Less Installed*" by picking up enough bundles for your next job from your electrical distributor.

Where tough corrosive conditions are your customer's problem, use Republic **DEKORON-COATED E.M.T.** and/or Rigid Steel Conduit to build prestige and profit.

**REPUBLIC STEEL**  
**STEEL AND TUBES DIVISION**



**Cleveland 8, Ohio**

**REPUBLIC STEEL CORPORATION**

**DEPT. EC -8936  
1441 REPUBLIC BUILDING  
CLEVELAND 8, OHIO**

Please send additional information on the following products:

- ☐ Republic **ELECTRUNITE E.M.T.**
- ☐ **GALVITE** Rigid Steel Conduit
- ☐ "DEKORON-COATED" E.M.T.
- ☐ The Bending System Booklet, S-D
- ☐ **ENAMELITE** Rigid Steel Conduit
- ☐ "DEKORON-COATED" Rigid

Name \_\_\_\_\_ Title \_\_\_\_\_

Firm \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

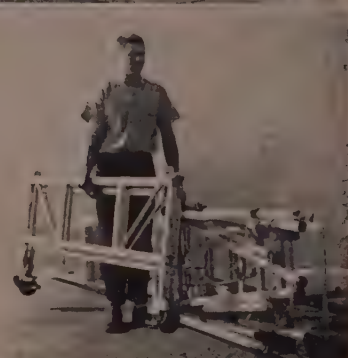
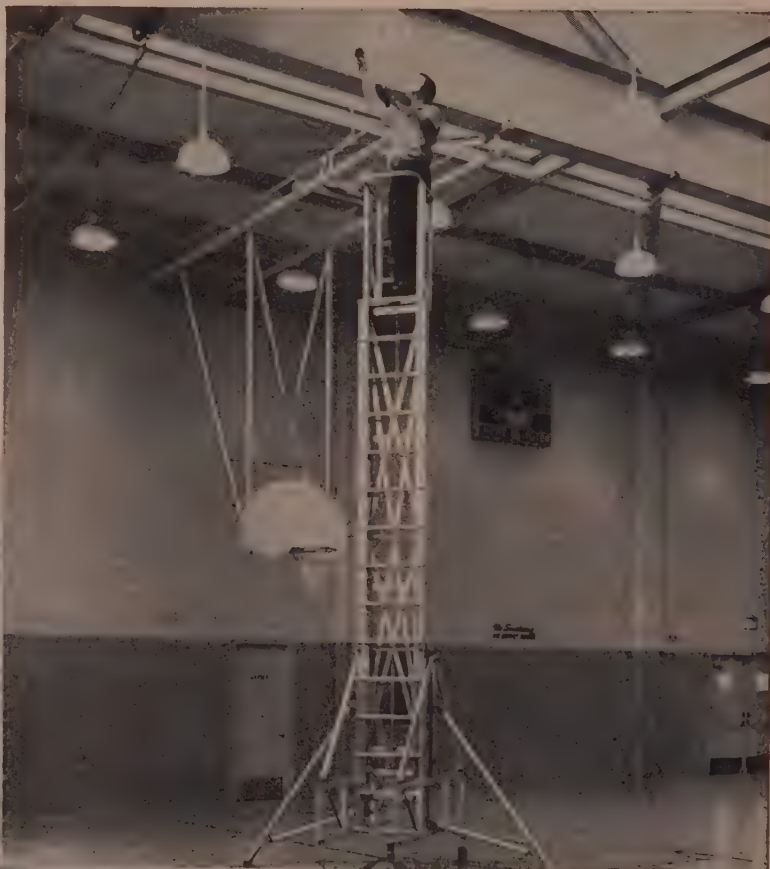


UP-RIGHT ANNOUNCES

# TALLSCOPE

...telescoping aluminum work platform for overhead construction and spot maintenance

Lightweight, rapidly assembled by one man. Extends instantly for reaching heights up to 30 ft. Telescopes for rolling under trusses and other obstacles. Adjustable legs for uneven floors or stairways.



Rolls through doorways . . . only 29" wide, telescopes and folds down.

Bridges over auditorium seats.

Separates easily into 3 components for convenient storage or transportation.

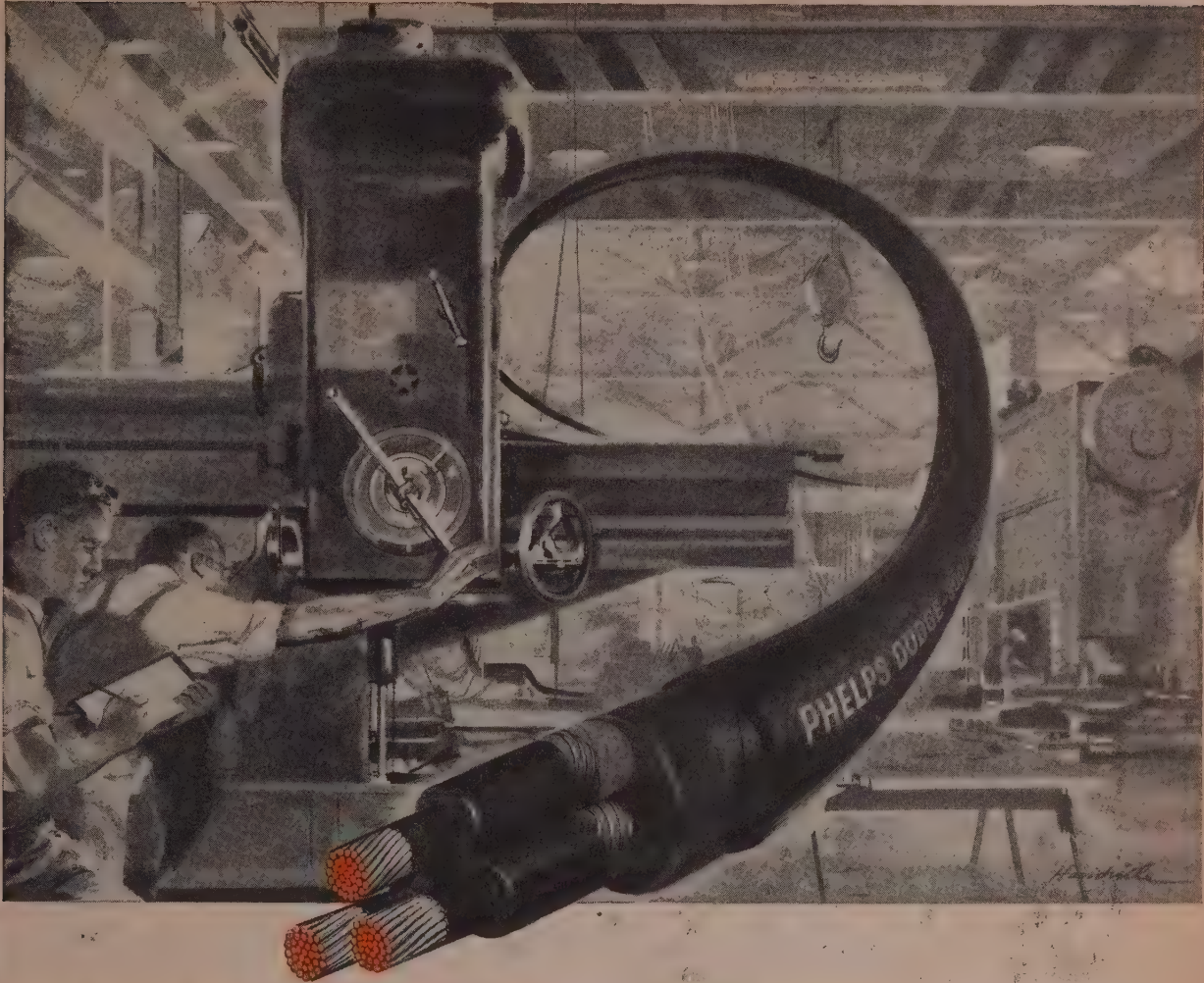


FOR TALLESCOPE CIRCULAR  
WRITE TO  
**UP-RIGHT SCAFFOLDS**  
DEPT. 177 • 1013 PARDEE ST., BERKELEY, CALIF.

MANUFACTURED BY  
**UP-RIGHT  
SCAFFOLDS**



*Steady plant production demands dependable power cable . . .*



## **HABIRITE-HABIRPRENE CABLE** **gives unexcelled performance!**

To help assure uninterrupted production, modern industrial plants require reliable cables for delivering electric power to production lines. The service reliability of Phelps Dodge *Habirite-Habirprene* is unsurpassed by any other rubber insulated neoprene jacketed type RR cable.

*Habirite-Habirprene* is a combination of specially engineered butyl rubber insulation and neoprene jacket. The overall features of this cable provide

greater resistance to heat, oxidation and ozone; improved electrical properties, including superior insulation resistance; higher copper operating temperature; superior flexibility; improved mechanical toughness against damage from installation hazards and extra resistance to corona, an absolute necessity for high-voltage neoprene jacketed cable.

As a general purpose cable, *Habirite-Habirprene* assures the utmost in safety, durability and reliability.

**See Your Phelps Dodge Distributor!**

**PHELPS DODGE COPPER PRODUCTS**  
CORPORATION



**SALES OFFICES:** Atlanta, Birmingham, Ala., Cambridge, Mass., Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Dayton, Denver, Detroit, Fort Wayne, Greensboro, N.C., Houston, Indianapolis, Jacksonville, Kansas City, Mo., Los Angeles, Memphis, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Richmond, Rochester, N. Y., San Francisco, St. Louis, Seattle, Washington, D. C.





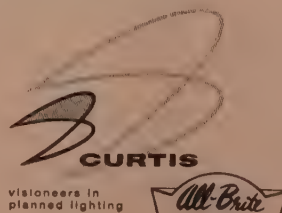
## How architectural design and planned lighting create an image of strength and friendliness in a bank

Somewhere between the coldness of Greek temple design and the casualness of the ranch house prototype, there should be an architectural concept for banks that inspires confidence, reflects stability, yet is not formidable. So reasoned Harry Weese, architect. Out of that came the new home of State Bank of Clearing, Chicago. Meaningfully shaped and purposefully illuminated, an image is created at State Bank which speaks of progressiveness, strength and friendliness.

Lighting is planned to create an inviting effect and at the same time is highly functional. Patrons move through an entrance of restful subdued light into a lower lobby of slightly higher light intensity, then into the main, high ceiling banking area. There a combination of indirect light and spot lighting presents a dramatic effect. A suspended ceiling achieves a peripheral clerestory so walls of brick are texture-lighted day and night.

On one side of the main high room is the officer area and on the

other, the teller area—both flooded with functional, non-glare, high intensity light which tends to direct customers to the areas. Curtis-AllBrite visioneers worked hand in hand with architect, illuminating engineer and contractor to accomplish this illumination innovation. Curtis-AllBrite Lighting, Inc., AllBrite Lighting Division, 352 Shaw Road, So. San Francisco, California; Curtis Lighting Division, 6135 West 65th Street, Chicago 38, Illinois.



Banking is serious business, so high visual acuity is necessary in the areas where close work is done. Here the officer area is bathed in a high level of soft, shadowless, glare-free illumination that is accomplished by a Curtis Strato-Lux Luminous Ceiling. Exclusive Curticell Louver-Diffuser panels combine diffusion of light source with proper shielding of the diffusing medium.



State Bank of Clearing, Chicago, Illinois, where an architectural concept and planned lighting bring something new and different in bank design and function. Illumination, both day and night, heightens an atmosphere of friendliness.



The main banking area where walls are texture-lighted by a wash of indirect lighting achieved with Curtistrip. Spotlights in the suspended ceiling add an atmosphere of action and provide high function, too.

Architect: Harry Weese & Associates.

Electrical Engineer: Sam R. Lewis.

Electrical Contractor: Crescent Engineering.





**U/L LISTED**

# NEW! LUGS FOR BOTH COPPER AND ALUMINUM WIRE

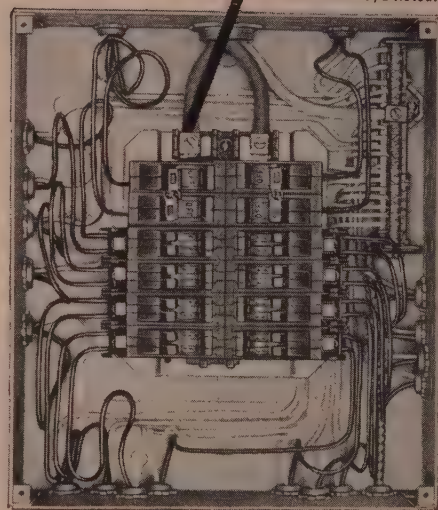
All General Electric load centers (100† and 200 amp.) and fuse pullers (100 amp.) are now U/L listed for both copper and aluminum wire—thanks to the new lug shown above which is standard on these devices at no extra cost.

Add this feature to the many advantages of G.E.'s new "twin" breakers and you'll see why more and more contractors are switching to General Electric for highest quality at the lowest cost. The "twin"\* lets you put two quality breakers in the space you usually take for one, use a smaller load center, and realize big savings on every job.

† Except TRM Series \* Trade-Mark

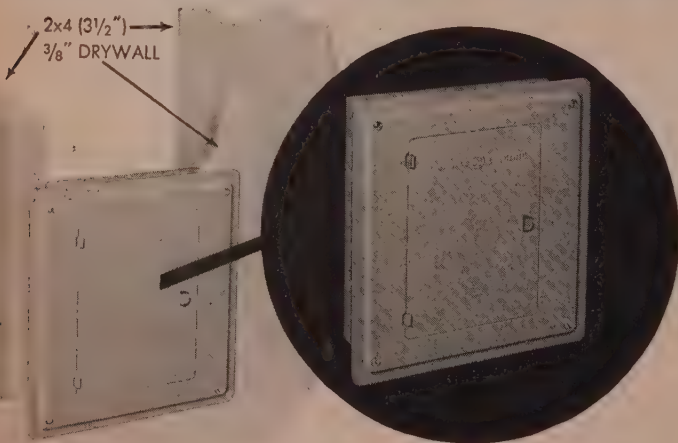


New lug holds wire fast, can't work loose. U/L listed.



## ***New G-E flush-front***

## ***load centers fit flush even with 3/8" drywall***



Here is a complete new line of flush-mounted General Electric "twin" load centers to answer your demands for equipment which fits flush with 2" x 4" studs and 3/8" drywall construction.

Ask your G-E distributor to show you the new *flush-front* load centers. Like all General Electric load centers, they feature Snap-Out interiors and provide automatic front alignment—even if the box is installed slightly off plumb.

**GENERAL  ELECTRIC**

Circuit Protective Devices Dept., Plainville, Conn.

# NEW SERVICE ENTRANCE EQUIPMENT



## 200-AMP CAPACITY... CIRCUIT BREAKER CONVENIENCE ... AT A COMPETITIVE COST

You will like the extra convenience of Heinemann's new 200-amp service entrance equipment . . . and so will your customers.

Trim, compact, smaller than comparably rated fused pull-outs, these units offer considerable savings in terms of easier installation and more efficient operation.

Installation features would make an apprentice happy. Wiring space is plentiful . . . connections are easily made with solderless screw-type connectors . . . knockouts are placed so that you can run-in conduit from any angle.

Completely non-thermal, the *magnetically* actuated Heinemann circuit breaker eliminates nuisance tripping and other temperature-caused troubles. You can therefore locate the unit wherever most convenient . . . next to heat lines or out in the hot sun, if neces-

sary. The breaker will always carry full rated current, will always trip as specified.

Breaker protection provides other conveniences as well: no bothersome fuse changing, simplified switching: the switch handle has only two positions: ON and OFF. No reset position; no confusion possible.

Rated at 120/240V AC, two or three wire service, the new Heinemann service entrance equipment is available in outdoor or indoor enclosures. Both are of heavy-duty steel in a grey baked enamel finish. Outdoor enclosures are raintight, with hinged covers that may be padlocked against tampering.

You'll be pleasantly surprised by the cost. It's little more than that of comparably rated fused equipment.

**For full information send for Bulletin 1003**

### HEINEMANN

**ELECTRIC COMPANY**

132 Plum Street, Trenton, N. J.

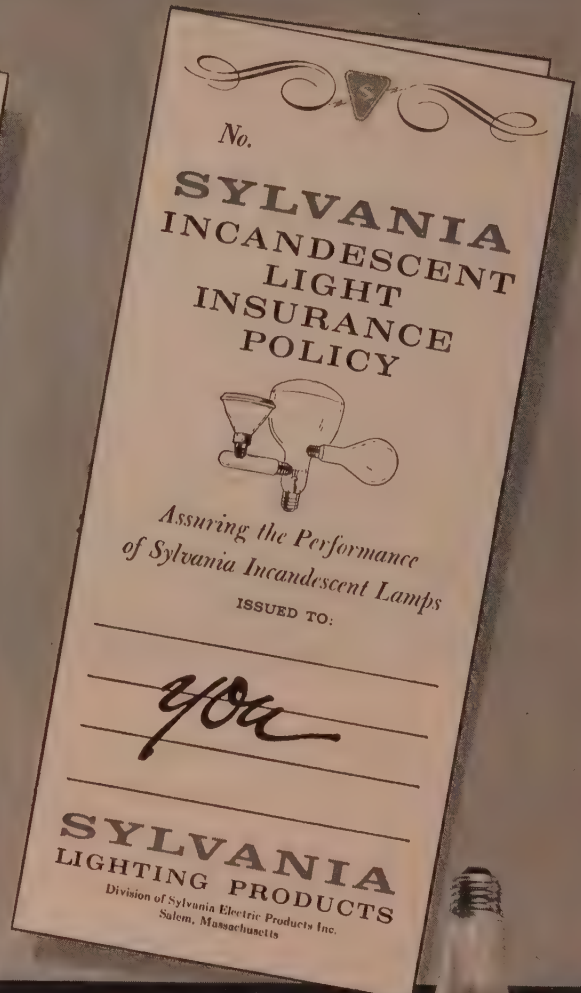
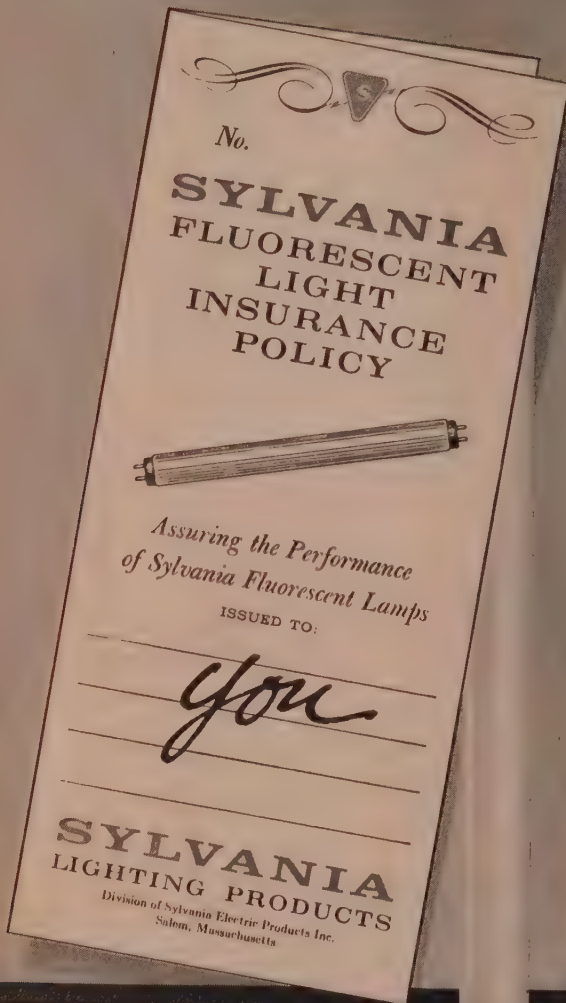
*Circuit breakers*





# Now Sylvania issues 4

AND YOU ARE



1 for Sylvania  
Fluorescents

2 for Sylvania  
Incandescents

**How can Sylvania do a thing like this?** Issue one insurance policy after another to *guarantee* that you get maximum lighting value . . . or your money back! Simple!

**Because** Sylvania in one lighting product after another *consistently* gives you the lowest TCL—Total Cost of Lighting—of any brand. (TCL equals cost of lamp or starter plus power plus maintenance.)

**Because** Sylvania lighting engineers *consistently* break the TCL barrier to bring you *more light* for less cost.

**Because** Sylvania—through its outstanding research and devel-

opment—has been *consistently* out front in superior lighting.

**There's just no question** that Sylvania lighting products *do* provide top performance and will keep right on doing it! (You don't think we *want* to return your money, do you?)

Next time you buy Fluorescents, Incandescents, Mercury Vapor Lamps, or Starters, be sure your representative or supplier gives you your exclusive Sylvania Light Insurance Policy. Or write us: Sylvania Lighting Products, a Division of Sylvania Electric Products Inc., Dept. 15, 60 Boston Street, Salem, Massachusetts. In Canada: Sylvania Electric (Canada) Ltd., P. O. Box 1190, Station "O," Montreal.

# light insurance policies...

THE BENEFICIARY!

No. 

**SYLVANIA  
MERCURY  
LIGHT  
INSURANCE  
POLICY**



*Assuring the Performance  
of Sylvania Mercury Lamps*

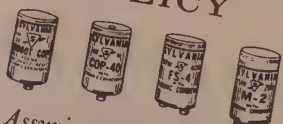
ISSUED TO:

*you*

**SYLVANIA  
LIGHTING PRODUCTS**  
Division of Sylvania Electric Products Inc.  
Salem, Massachusetts

No. 

**SYLVANIA  
FLUORESCENT  
STARTERS  
LIGHT  
INSURANCE  
POLICY**



*Assuring the Performance  
of Sylvania Fluorescent Starters*

ISSUED TO:

*you*

**SYLVANIA  
LIGHTING PRODUCTS**  
Division of Sylvania Electric Products Inc.  
Salem, Massachusetts

**3** for Sylvania  
Mercury Vapor Lamps



**4** for Sylvania  
Starters

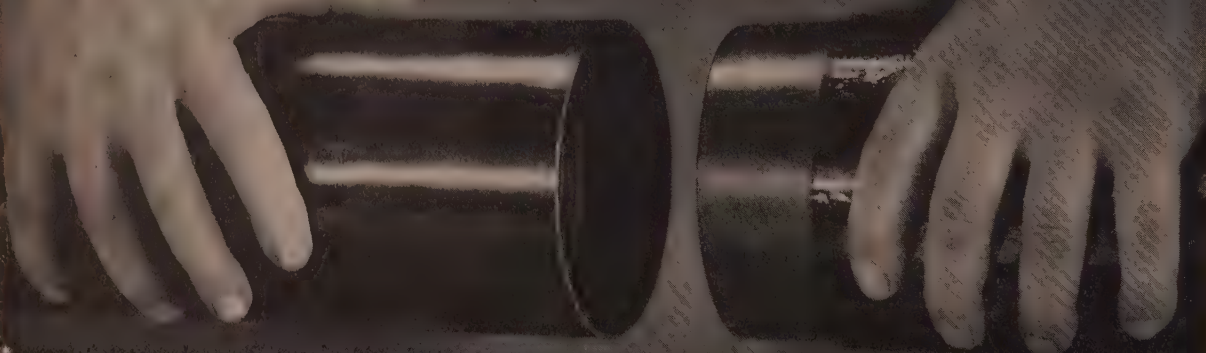


# SYLVANIA

Subsidiary of **GENERAL TELEPHONE & ELECTRONICS** 



# CUTS assembly time 26%



*factory-attached, flush coupling Δ no additional cost!*

## New **ORANGEBURG® CA\*** CONDUIT with Flush Coupling Attached!

With no separate couplings to handle or attach on the job, Orangeburg CA lays faster, costs less to install. Each long, light length has a *flush* coupling attached at one end and a standard 2° male taper at the other end, making installation a simple, one-step operation. And, since the coupling is attached, there are no coupling cartons to warehouse or carry to the job.

What's more, with the coupling *flush* to the conduit's outside wall, new CA is easy to stack, store and handle. The flush coupling also eliminates "staggered" joints in the trench. And that means real savings in cutting and tooling time. Like the hundreds of millions of feet of Orangeburg fibre

conduit in use since 1893, new CA has self-sealing joints and impermeable walls. Its smooth, 100% fibre raceway adds years to cable life.

New Orangeburg CA is available in 2", 3", 3½", 4", 4½" and 5" sizes. Orangeburg Standard and Nocrete Conduit, with separate sleeve couplings, are available as always. Write Dept. EC-20 for Catalog 52.

**ORANGEBURG MANUFACTURING CO.**  
Orangeburg, New York • Newark, California  
Division of The Flintkote Company, Manufacturer  
of America's Broadest Line of Building Products



Orangeburg Fibre Conduit is distributed by Graybar Electric Co. and General Electric Supply Co. with branches and stocks in principal cities.



Assure more usage per  
roll of plastic electrical tape  
**Ask for J-M DUTCH BRAND**  
contractor's size roll.

Contractors find they save money with Dutch Brand's convenient packaging and complete line of tapes. For example, our contractor's-size roll of plastic electrical tape is a full 44 feet in length. This special size—exclusive with Dutch Brand—allows far greater economy in allocating materials to a job. Waste is cut to an absolute minimum for this is the length studies show a workman uses on an average job. Here's a worthwhile saving when you figure tape wastage per man and multiply it by the number of men in your crew. Yet, this 44-ft. roll costs you *no more* per foot than larger rolls.

Dutch Brand Plastic Electrical Tapes are avail-

able in 44-ft. and 66-ft. rolls. They're thin, strong, flexible—offer unusual resistance to acids, alkalies, oil, solvents, fungus, bacteria, gases. Made to meet the highest industry standards. Ask your supplier for Dutch Brand now. *Johns-Manville Dutch Brand Products, 7800 South Woodlawn Avenue, Chicago 19, Illinois.*

**WRITE FOR NEW  
BOOKLET!**

Looking for new ideas on tape  
as a time- and -money-saver?  
Ask for "Big Four in Electrical  
Tapes." Do it today!



**JOHNS-MANVILLE**

JOHNS MANVILLE  
**JM**  
PRODUCTS



# Rigid steel conduit permanently protects circuit conductors against physical damage

So certain is this protection that the National Electrical Code includes the use of rigid steel conduit for all applications and locations—both inside and out. And, it *specifically* requires rigid steel conduit in particularly hazardous locations with explosive atmospheres.

*Why?* Because rigid steel conduit possesses great strength; provides a grounded metallic system, and cannot be damaged by moving objects. What's more, in case of a mishap due to faulty wiring, lightning, sudden shock or overloading, rigid steel conduit contains the damage and keeps it from spreading.

Rigid steel conduit is easy to install, too! It bends, threads and cuts with a minimum of effort. It is also compatible with all building materials, adaptable to all construction, fits anywhere and expands easily.

*America's leading steel pipe manufacturer  
supplying America's foremost conduit manufacturers.*



**National Tube  
Division of  
United States Steel**

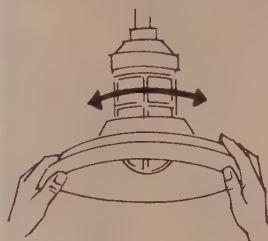
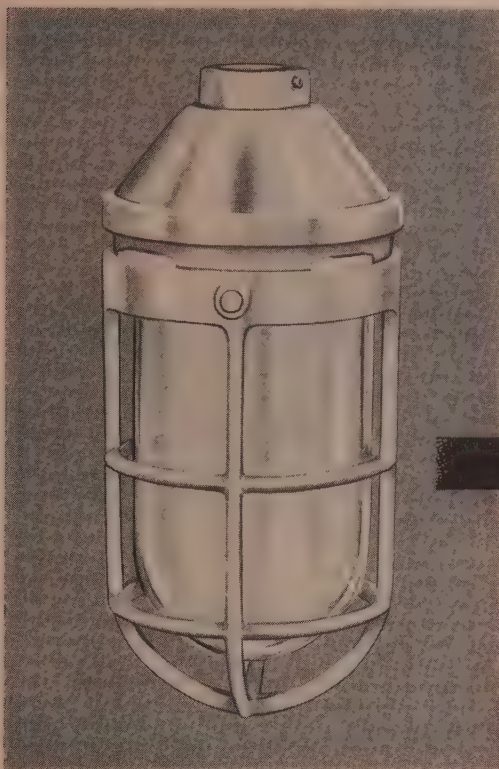
Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors  
United States Steel Export Company, New York

# NEW PYLE

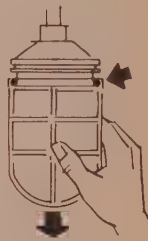
## ALUMINUM VAPORTIGHT LIGHTING FIXTURES

### COATED WITH PEC-9 FOR THE TOUGHEST JOBS

*Resists salt spray, acid fumes, strong caustics and organic liquids (no extra price).*



Reflectors, removable by a 45° turn without tools for convenient cleaning, have four self-locking nylon shoes.



Guards with stainless steel ball detents removable without tools for convenient lamp changing independent of reflector.

### no tools required for re-lamping and cleaning



Fixture rigidly secured to pendant. Thread cannot be loosened when removing guard, globe or reflector.



Air flow through reflector keeps fixture cooler, cleaner and brighter.

### Simplified Maintenance—New materials, design and reliability!

- Material: Die cast aluminum components. Heat resistant globes are standard in a choice of colors. Specification grade porcelain lamp holder and all-white porcelain enameled reflectors.
- Design: Interchangeable straight and 90 degree bracket mounting adapters fit both 100 watt and 200 watt fixture sizes. Lamp holder gasket seals off wiring and lamp compartments.

- Corrosion-resistant PEC-9 white coating furnished as standard eliminates need for application of special compounds in the field to protect metal components against salt spray, acid fumes, strong caustics and organic liquids.
- Dome, shallow bowl, deep bowl and 30 degree all-white reflectors greatly enhance the appearance of the fixture wherever installed.

*Fixtures are U/L and CSA approved and meet Navy, Corps of Engineers and General Service Administration specifications.*



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COMPANY**

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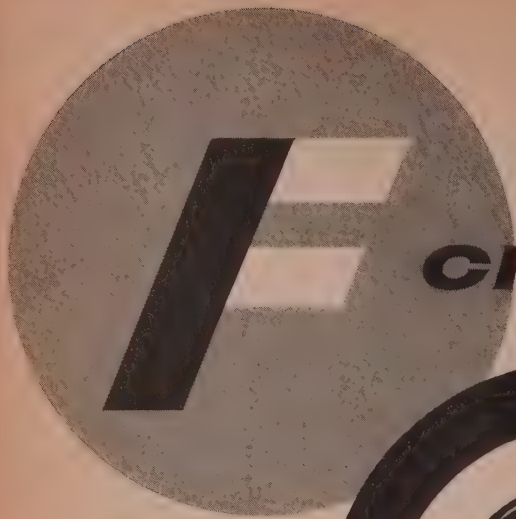
**1344 North Kostner Avenue, Chicago 51, Illinois**

Subsidiary: PYLE-NATIONAL (CANADA) LTD., Toronto 15, Ontario

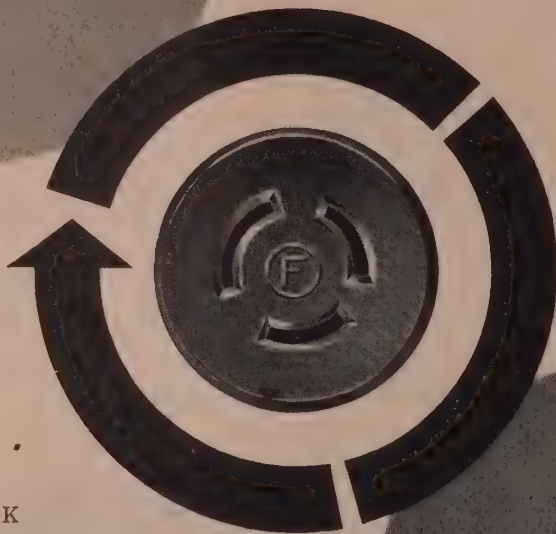
Railroad Export Dept.: International Railway Supply Co., 30 Church St., New York 7, N. Y.  
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CONNECTORS • CONDUIT FITTINGS • CIRCUIT CONTROLS • LIGHTING FIXTURES • FLOODLIGHTS



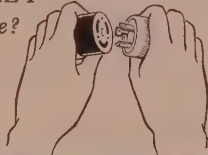


# CIRCLE F



*one source  
for all  
wiring devices...*

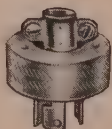
With the addition of CIRCLOCK interlocking devices, Circle F is the single, best source for all residential, commercial, and industrial wiring devices. Like all Circle F devices, CIRCLOCK has been designed for maximum safety. A simple twist and the connection is locked securely and just as easily a twist disconnects. Join the manufacturers and designers of electrically operated machines who specify Circle F's CIRCLOCK. Make all your wiring devices CIRCLE F—you can't buy better so why pay more?



2621



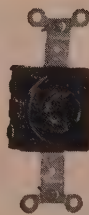
2622



2613-A



2619-A



2631



2632



2931



## CIRCLE F MFG. CO.

TRENTON 4, NEW JERSEY • For your wire requirements: Eastern Insulated Wire Corp., Box 591, Trenton, N. J.

# INSTALLED IN 3 MINUTES

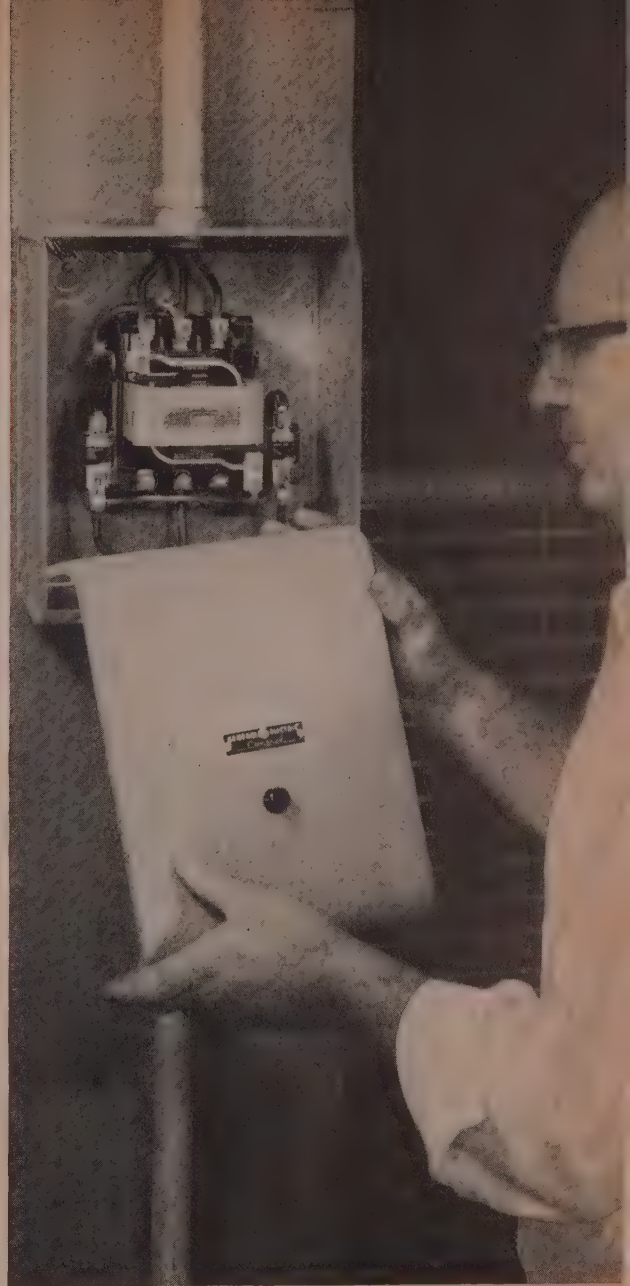
Design advantages of  
General Electric CR106  
magnetic starters save  
installation time and costs

Because of such important design advantages as straight-through wiring, pressure-type terminals, three-point mounting and front accessibility, General Electric 100 Line magnetic starters (size 0, 1 and 2) can be installed in just three minutes in a mounted enclosure.

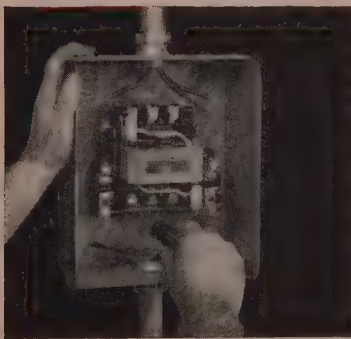
We invite you to measure these advantages by the minutes and dollars they can save in your installation work. For more information contact your apparatus distributor or write General Electric Co., Section 732-4, Schenectady, New York. Ask for bulletin GEA-7020.

you get **MEASURABLE ADVANTAGES**  
WITH GENERAL ELECTRIC CONTROL

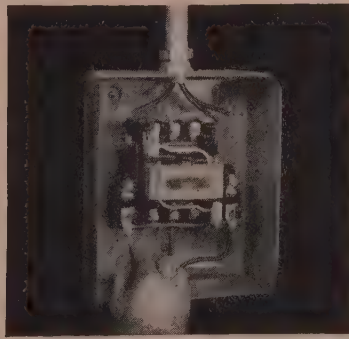
GENERAL  ELECTRIC



**9:00 AM** A size 2 starter, for example, can be mounted in enclosure quickly and easily. It is 55% lighter, 34% smaller than previous open forms.



**9:01 AM** Three-point mounting of starter speeds installation. Keyhole slot at top and 2 slots at bottom slide over mounting screws. Just "hang on and tighten."

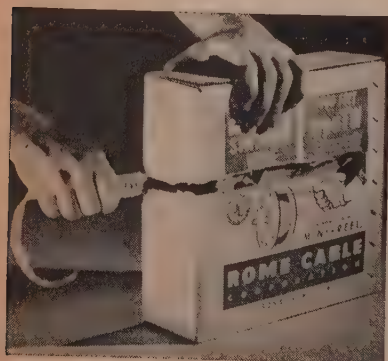
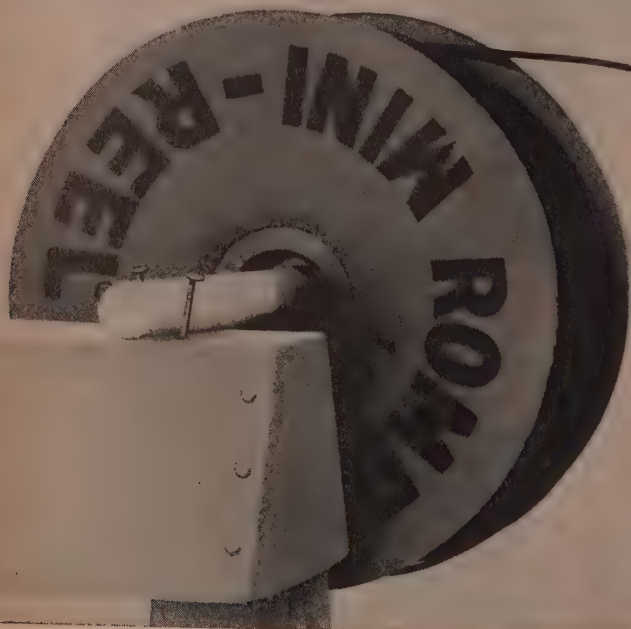


**9:02 AM** Straight-through wiring saves time because no leads need to be bent around sides of the starter. General Electric enclosure has 10% additional wiring room.

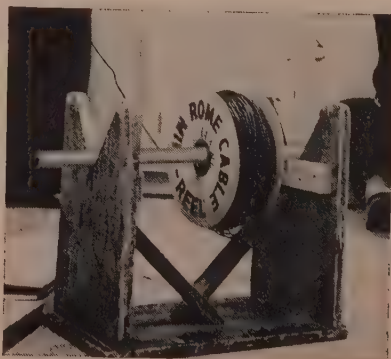


**9:03 AM** Pressure-type terminals are accessible from the front—easy to see and easy to reach. Just insert stripped wire in the terminals and then tighten.





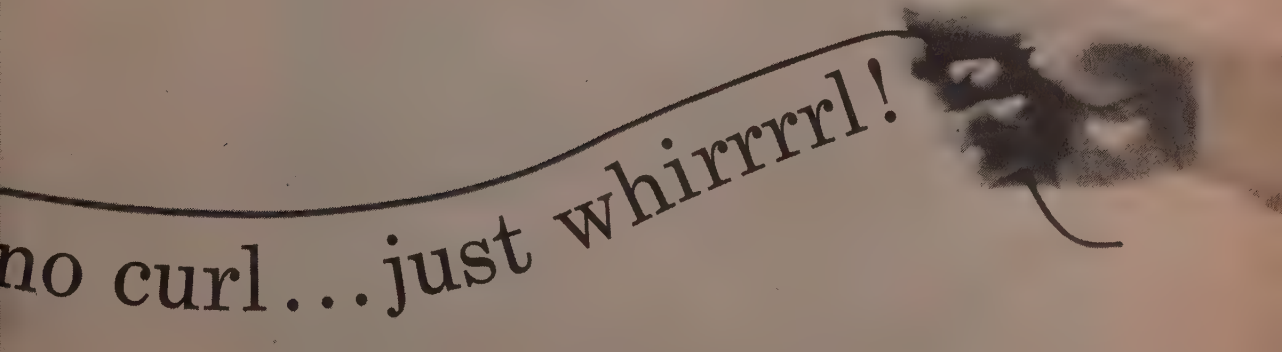
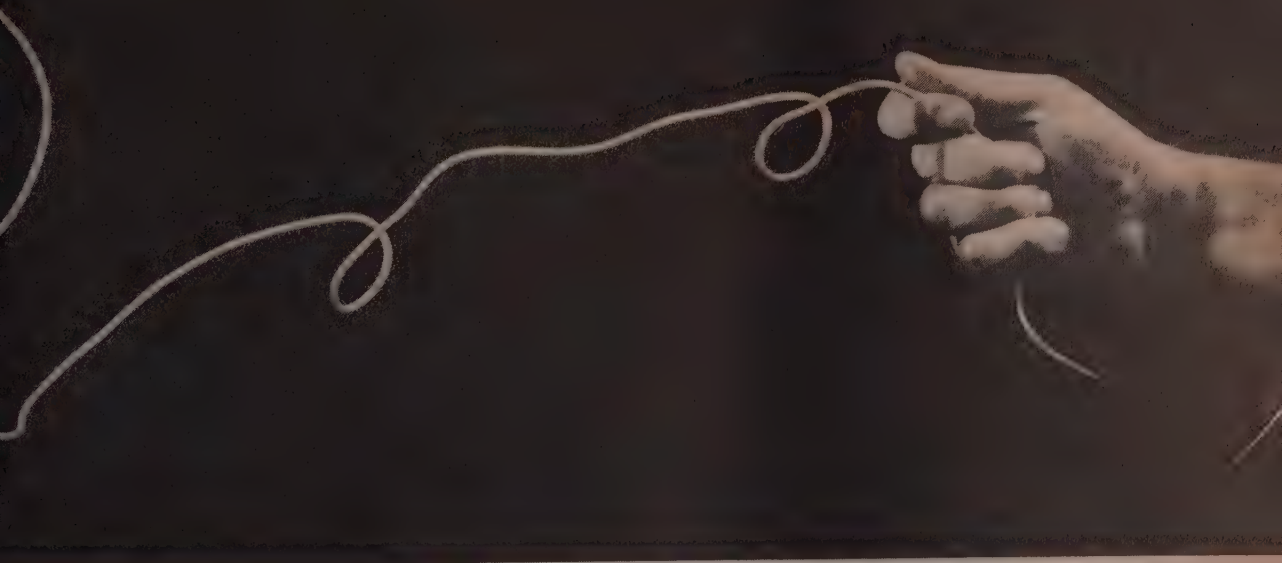
**EASY TO OPEN.** Just pull the rip cord on carton. One reel holds 1000 feet of No. 14 or No. 12 Solid Type TW.



**EASY TO USE.** Insert a pipe or piece of conduit through center of MINI-REEL and mount it on any suitable rack.



**UNLIMITED USES.** Mounted on studs right at the job site, it's ready for quick use. Possibilities are endless.



## MINI-REEL...A NEW PACKAGING IDEA FROM ROME!

Who do *you* think will finish the job first?

The man who works with twisted wire, pulling from the center of a standard coil, or . . .

The man who unwinds wire that can't kink or twist as it comes off Rome's new MINI-REEL?

Answer: the second man does the job faster with MINI-REEL! Installation is safer, too—there's less chance of damaging the wire.

You can get Rome Synthinol in eight standard colors of No. 14 and No. 12 Solid Type TW in this new MINI-REEL package at no extra cost!

You can unwind several reels at once in paralleling conductors for control circuits and other jobs. Respooling any excess is easy.

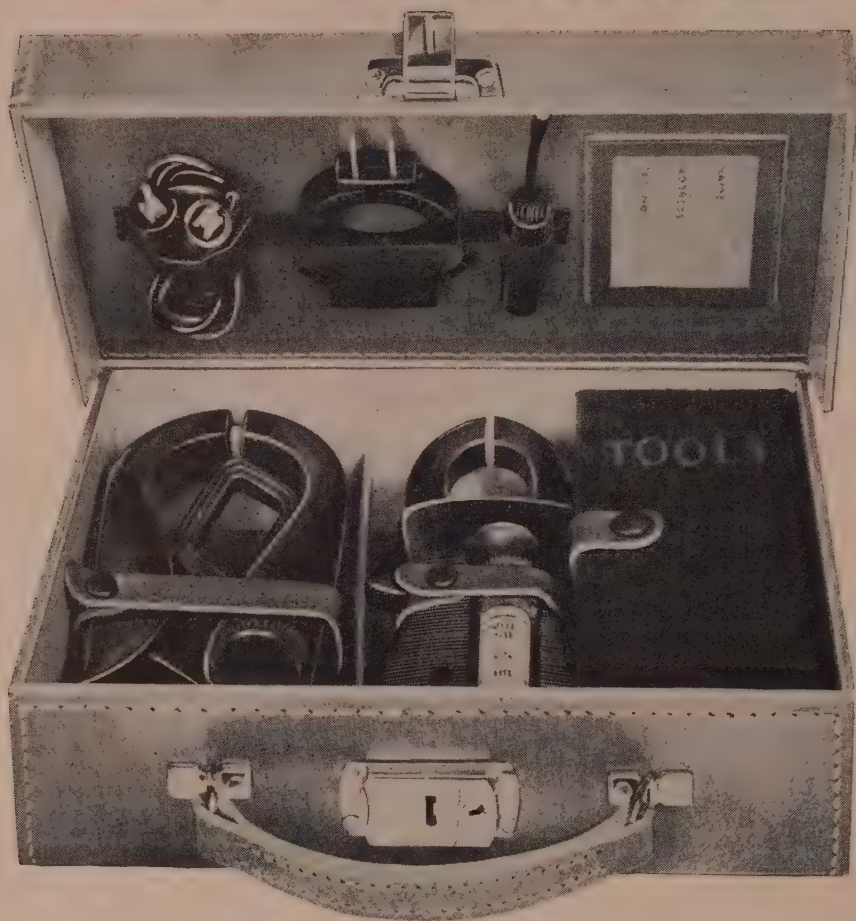
Because MINI-REEL is so compact, you save shipping and storage space, too! This new package holds a 1000-foot length of wire in the same size carton used for 500-foot lengths. One man can stack and load the same footage in less time than required for 500-foot packages. Just one "tag end" per 1000 feet saves scrap, besides.

Ask your Rome salesman for the MINI-REEL package the next time you need No. 14 or No. 12 TW. Or write to Rome Cable Corp., Dept. 712, Rome, N.Y.

**ROME CABLE**  
DIVISION OF **ALCOA**



# All your answers are in the bag with **PYRAMID**



## **Amprobe** Test-Master Kit keeps all equipment right at hand...handsomely.

Truly the sign of the professional, this rugged, good-looking, genuine cowhide case contains all the equipment *you* need to do all your electrical testing jobs with precision and accuracy.

Compact, neat and sturdy, the Test-Master Kit is specially designed to hold any one of the famous Amprobe RS models, the Amprobe Deca-Tran, the Amprobe Energizer and the Test-Master has a separate covered section to hold your small hand tools easily, within reach.

*The Test-Master comes in two models: **TM33** contains the world-famous Amprobe RS-3 snap-around volt-ammeter-ohmmeter: 5 current ranges, 3 voltage ranges. Amprobe Deca-Tran: Extends amperage reading 10x, as high as 1200 amps. Amprobe Energizer: Multiplies sensitivity of any Amprobe 10x for readings on small appliance and fractional h.p. motors. **\$84.50***

**TM11** contains the Amprobe RS-1, economy snap-around volt-ammeter. Amprobe Deca-Tran and Amprobe Energizer. **\$71.75**

*The Amprobe Test-Master Kit, RS-3, Deca-Tran and Energizer are all products of*  
**PYRAMID INSTRUMENT CORPORATION, LYNBROOK, N.Y. WORLD'S LARGEST MANUFACTURER OF SNAP-AROUND TEST INSTRUMENTS**

## **Maintenance Costs**

**Electrical maintenance**, as an orderly method of contending with trouble, is generally recognized as an essential cost in plant operation. It is less expensive than trouble or its consequences; so cost-conscious management tolerates, sometimes grudgingly, its constantly increasing outlays for materials, personnel and outside services.

**As an outright expense**, maintenance is unfortunately devoid of any appreciable compensating income. It produces no marketable product from which management can derive a profit—at least in a manner that can be readily isolated and identified. As a result, management people tend to bear down on maintenance budgets more critically than on other costs which may seem more closely related to the main stream of production.

**Such reactions are not**, of course, the thoughtful attitudes of competent management people toward the maintenance function. But, unfortunately, they often represent the general mental background that the electrical maintenance engineer must be able to contend with when he submits budgets and programs for executive approval. What's needed is a method for appraising maintenance costs that factors in some measure of results.

**One way to represent maintenance costs more accurately** is to charge maintenance with down-time when stoppage occurs through machine or system mal-function. This practice may, at first, look rough on the maintenance department, but in the long run it gives maintenance a chance to demonstrate the effectiveness of scheduled preventive maintenance programs.

**Lighting system maintenance cost appraisal** requires a different approach, but the problem is still capable of objective analysis. By calculating cost-per-million-lumen-hours for a variety of maintenance schedules, an optimum or preferred program can be determined. Such tests often indicate that more maintenance attention is needed to achieve the lowest total cost.

**More lighting, more power, more complex controls** and the rapidly growing family of special electrical systems going into industrial plants are piling new tasks on electrical maintenance forces. The costs are climbing as they must. But the true measure of maintenance performance is its effect on total production.

**Cost analyses, if they are to be meaningful**, must reflect the overall picture. Management is routinely concerned with holding department costs in line. It should be equally watchful in these times to insure that maintenance functions are adequately supported to serve their increasing responsibility for plant output.

*Wm. T. Stuart*



## Cutler-Hammer Three-Star Motor Control

★ *Installs easier*

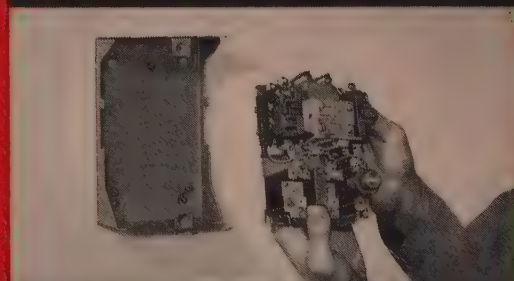
★ *Works better*

★ *Lasts longer*

★ The cost of installing motor control is almost always greater than the cost of the control. That is why Cutler-Hammer engineering made "easier installation" a key objective in the design of Cutler-Hammer Three-Star Motor Control. Compare the many outstanding design features of this control with any other and see how you can get the job done in less time with less cost to you and your customer when you install Cutler-Hammer Three-Star Motor Control. See your nearby Authorized Cutler-Hammer Distributor . . . he stocks all needed types and sizes of Cutler-Hammer Three-Star Motor Control. Also, write for the Cutler-Hammer Merchandiser, Pub. EA-100-C-241, the handy motor control selection guide. Cutler-Hammer Inc., Milwaukee 1, Wisconsin.



1 Loosen two cover screws and the wrap-around cover slides off exposing the entire starter mechanism. Captive cover screws stay in the cover . . . no time wasted searching for lost cover screws.



2 Remove the entire starter mechanism by loosening three screws. Then the enclosing case can be easily wall or machine mounted. Embossed mounts insure a firm installation even on irregular surfaces.



3 Once the case is mounted, conduit connections are easily made and wires can be drawn without any interference from the starter mechanism or case walls . . . no skinned knuckles or damaged starters.

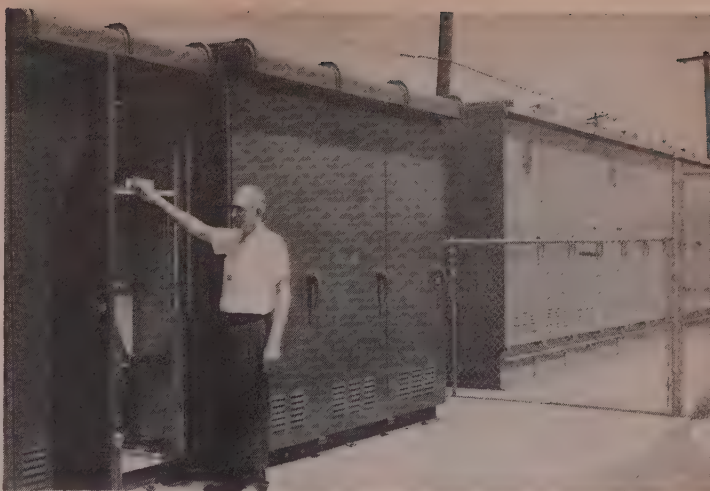


4 Replace starter and wire. Wiring diagram gives complete directions, terminals clearly marked, and panel wiring color coded. Other plus features include straight-through wiring and front mounted adjustable overload heater coils.

# CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wis. • Division: Airborne Instruments Laboratory. • Subsidiary: Cutler-Hammer International, C. A.  
Associates: Canadian Cutler-Hammer, Ltd.; Cutler-Hammer Mexicana, S. A.; Intercontinental Electronics Corporation.

**JACK WELLS**, electrical supervisor for Stone & Webster Engineering Corp., points to one of the 4,160-volt primary switches located next to the 5000-kva outdoor substation. Feeders shown in Fig. 1 are fed from here.



## *Electrical Highlights of . . .*

# **A Modern Race Track**

The world's newest horse racing track uses special electrical systems and equipment to stimulate spectator interest and speed up operations.

**By E. F. Cassidy**, *Electrical Engineer*  
Stone & Webster Engineering Corp., Boston, Mass.

**E**LECTRICAL facilities play a major role in the operation of the new Aqueduct Race Track of the New York Racing Association Inc. Features include 4160-volt feeders; 480/277-volt load centers; and equipment for emergency, sig-

nal, public address, closed-circuit TV, totalisator and photo-finish systems. A total network capacity of 5,000 kva is provided.

Aqueduct lies on a 203-acre tract in the Borough of Queens, Long Island, N. Y., near Idlewild Air-

port. Subways and a network of parkways provide access to the track. Parking spaces handle up to 12,000 cars; and a newly constructed transit station serves 40,000 people on a peak day.

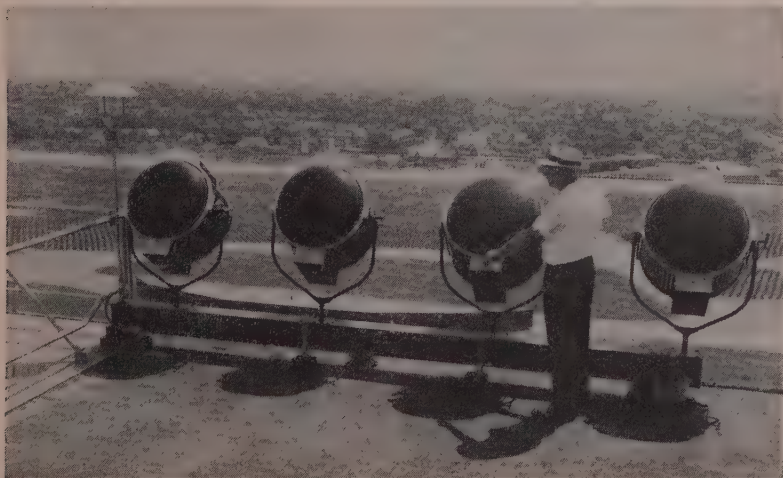
Twenty thousand seats are provided in the 1,150-ft long grandstand, with facilities for a peak attendance of 75,000 persons.

Ground floor offices serve the administrative staff, officials and track personnel.

Levels above the ground floor are principally for seating decks, pari-mutuel betting services, food and lounge facilities. Approximately 675 pari-mutuel windows, distributed in groups throughout the public areas, handle betting. There are two press boxes, one above and one below the roof deck.

### **Primary Feeders**

Primary service supply comes from a new Consolidated-Edison Co. network substation at the edge of the property. From here, two



**FOUR 10-KW FLOODLIGHTS**, located on the roof of the new Aqueduct grandstand, are used to supplement daylight and assure clear photo-finish pictures.



4,160-volt feeders extend in underground ducts to the grandstand (Fig. 1). Each feeder supplies two 1,000-kva unit substations. In each substation, transformers reduce the voltage to 480/277 for distribution throughout the grandstand. Also, primary feeders extend to a 150-kva unit substation under the infield tote board; and supply a 525-kva load to five unit substations in the stable area.

With the use of a three-position switch, either of two 4,160-volt feeders can supply the tote board substation. Therefore, service to the tote board is insured. And this is important, since without the tote board, betting is delayed, if not stopped.

### Secondary Distribution

There are four unit substations on the ground floor of the grandstand, each with a fused primary switch, 1,000-kva dry-type transformer, and ten 400-amp circuit breakers (rated at continuous current and 30,000 amps interrupting capacity). One transformer uses fans to increase its rating 33½%, and the fans are automatically controlled by the temperature of the transformer winding.

At each substation the secondary voltage is 480/277, 4-wire, 3-phase wye, with 277 volts supplying fluorescent and mercury lighting units, and 480 volts serving building service motors ½ hp and larger. Since these loads represent a large amount of the total load, and because the vast floor areas of the

structure total 23 acres, the 480/277-volt system was selected. Also, this system was more economical than lower-voltage systems because less conduit, wire and panelboards were required.

Feeding from the 480-volt distribution, dry-type transformers supply the 120 and 240-volt equipment. These transformers are in each of 14 electrical equipment rooms situated throughout the grandstand. Also, the equipment rooms serve as locations for lighting, power and motor-control panels. Incandescent lighting, used mainly in dining rooms and lounges, represents the majority of the 120-volt equipment. Electrical requirements of the dining areas comprise the remainder of the 120-volt load, and most of the 240-volt load. Seven kitchens serve the dining areas and 62 refreshment stands. About 20% of the power demand supplies these facilities.

Each of three entrance lobbies on the ground floor has a pair of escalators that extend from the ground floor to the third floor. All escalators are reversible, and each pair provides alternate or uni-directional travel, depending upon crowd flow.

### Lighting

The variety of lighting fixtures selected ranges from the standard single lamp fluorescent strip to a decorative "brandy snifter" fixture in the Turf and Field Club reception area. Choice of a wide range of fixtures made it possible to achieve the lighting effects desired and

conform to the aesthetic values important to the architect. Over 100 different types are among the total of 9000 fixtures. Continuous rows of 8-ft 2-lamp luminaires, spaced on 30-ft centers at a mounting height of 18 ft, provide the general lighting in the betting areas. These luminaires are an industrial-type fluorescent fixture with porcelain-finished reflectors and anodized aluminum channels. Proximity to salt water and ease of maintenance influenced the choice.

Openings in the top of the reflectors minimize the collection of dust on the lamps and give 15% up-light to reduce ceiling darkness and undesirable contrast.

While the track is for daytime operation, some lighting of the seating area is required for cleanup operations after racing patrons leave. The roof over the seating area has a virtually unobstructed ceiling area, 135 ft wide and 1,000 ft long. To retain the smooth roof appearance and still provide lighting over the seating area, only one lighting unit serves each 30-ft bay. Efficiency and ease of maintenance influenced the choice of a 400-watt mercury, high-bay, wide-spread reflector luminaire. Hangers permit the units to be lowered for servicing.

Three basic types of lighting units provide the outdoor lighting. The unit that lights over a mile of roadway incorporates a recent development in mercury street lighting. This is a luminaire with a 400-watt color-corrected, mercury lamp and self-contained ballast, thus

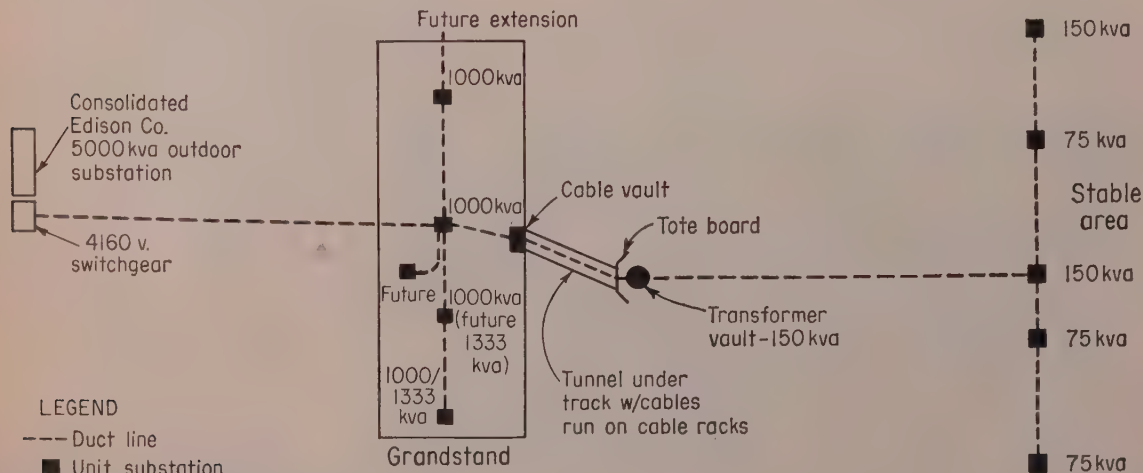
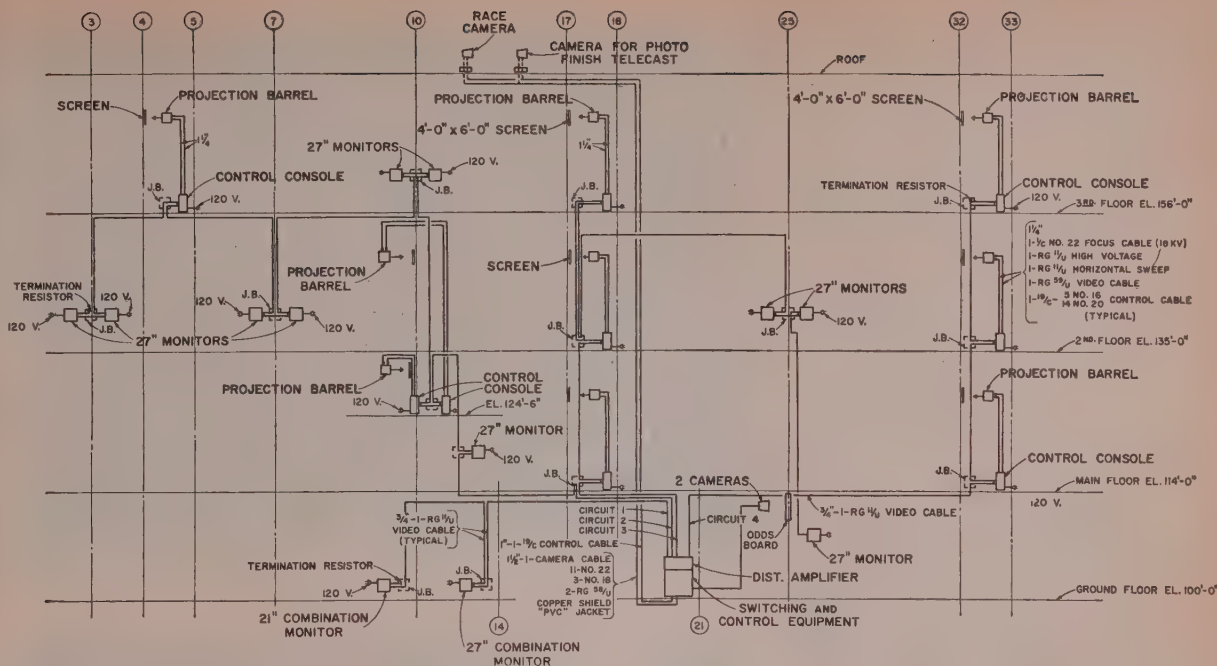


**FIG. 1. PRIMARY FEEDERS** at 4,160 volts supply nine unit substations. Each substation contains a primary and secondary switchboard, and dry-type transformers supply power

for 480/277-volt and 120/240-volt loads. Panels are located in the substations. Provision is also made for an additional substation, if needed later.



**RISER DIAGRAM** indicates the conduit, cable and equipment used for the closed-circuit TV system. Twelve 27-in. TV monitors and nine 4 ft by 6 ft projection screens show the

actual running of each race and indicate the posting of odds and results for each race.

eliminating the transformer-type pole base. Because of its efficiency and long lamp life, mercury lighting is also used in the 80-acre parking area. This essentially daytime operation does not require high intensities of light. But sufficient illumination enables patrons to reach their cars safely in the twilight after late fall racing meets. Spaced at 400-ft intervals, lighting units consist of four 1,000-watt mercury lamps in wide-light reflectors atop 50-ft aluminum poles.

Lighting units selected for the landscaped plaza area at the rear of the stands are decorative post-top fixtures of contemporary design, with a 150-watt silver-bowl lamp, translucent globe of white Plexiglas and aluminum hood. Aluminum poles for the units are 9 ft high.

Luminaires of extruded aluminum housings with Plexiglas diffusers and fluorescent lamps provide the lighting for 1,200 ft of covered walkways.

### Emergency Lighting

A 50-kw emergency generator operates automatically on loss of power in any of the four unit substation feeders and provides power for exit lighting in addition to lighting units in public and operation areas. Thus, safe movement

of the patrons is assured during a period of temporary loss of power. Emergency power for the public address system also feeds from the generator.

Service cables for the telephone company extend in underground ducts from the street supply to a

manhole located at the ground floor level of the building. From this point, underground conduits carry the lines to two telephone equipment rooms—one for NYRA and one for the concessionaire. These rooms house the dial switching racks and other telephone company equipment.

There are three dial systems on the NYRA telephone facility—NYRA administrative, Mutuel Department and Pinkerton. A user on any one of the systems may dial only telephones on that system, unless special arrangements are made. Because of regulations governing the use of telephones at race tracks, only a limited number of telephones have outside dialing privilege.

### Signals

Protection of the patrons is the responsibility of the Pinkerton organization, the Thoroughbred Racing Protective Bureau and the staff of NYRA. Several types of signals and communication services assist in the transmission of information and alert the various security groups. One system of switches and lights will bring an officer to a mutuel seller or cashier who may need assistance. Signal lights and call boxes, throughout the public areas, alert the patrol officer and place him in communication with



**TYPICAL ARRANGEMENT** of secondary equipment in each unit substation shows wall- and floor-mounted dry-type transformers adjacent to 480/277-volt and 120/240-volt panelboards. The transformers shown here supply the 120/240-volt loads.



the officer in charge. An intercom system within the Pinkerton offices gives the officer in charge an immediate communication channel to his staff. Each entrance gate has telephone contact to headquarters.

Signal lights throughout the stands and the infield tote board alert the patrol officers of the TRPB.

Other signal systems include a warning horn which sounds five minutes before closing of the mutuel windows. Later, signals light in the mutuel sections to indicate the start of payoff after results are official.

A private telephone system provides the patrol judges with plug-in portable telephones at each judge and starter position around the track. A telephone and loudspeaker are located in the stewards' room in the upper press box area. Any of the judges or the starter may talk over the system, with the loudspeaker alerting the stewards who then call the judges.

There are five camera towers around the track from which the film patrol photographs the entire race. Each cameraman has immediate and private telephone connection with the supervisor in the film patrol room.

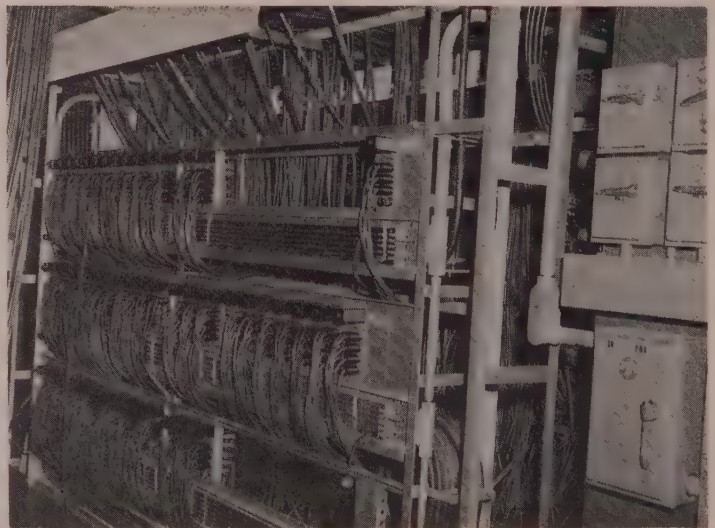
Manual fire alarm boxes are at convenient intervals on all floors. These boxes connect to the plant fire alarm and detection system, and from there run to a central station alarm reporting service, alerting the fire department. The main watchmen's building is the nerve center of the system and houses the master control cabinet and its accessories. Also, fire detectors throughout the stable area buildings and outdoor manual boxes in the stable area connect to the fire alarm system.

An extensive public address or "race call" system carries the voice of the race announcer to all public areas. More than 200 large re-entrant horns are over the seating areas, and over 300 cone-type speakers serve the betting areas. In hung ceilings the speakers are recessed. The race call system is of the low-level-sound type that requires a large number of speakers to serve the building, without annoying disturbances to nearby residents.

Part of the operational setup of the mutuel department includes a general information intercom-system. Speech input stations are in the mutuel manager's office, cal-



**50-KW GENERATOR** provides emergency power for exit lighting and PA system in event of power failure. The unit starts automatically if power fails.



**PART OF THE MAZE** of cables used for the totalisator system is shown on one of the switching racks in the tote room.

culator room and tote room. Speaker stations are in the mutuel sections where the sellers and buyers are located. There is a communication channel called the mutuel payoff results, intercom system. This system originates from three acoustically treated broadcasting booths in the calculator room to speakers at each cashier's window with individual volume control. Each microphone station has a switching station to permit broadcasting payoff results to certain groups of cashiers' windows. By control of a 3-way or 2-way switch, as required, one broadcaster covers all \$2 windows, \$6 combination win-

dows and \$15 combination windows. A second booth covers all \$5 and \$10 windows, while a third covers \$50 and \$100 windows.

### **Closed Circuit Television**

Racing patrons can view the posting of odds and results on a dozen 27-in. TV monitors in cafeterias, dining rooms and lounges, and on nine 4-ft by 6-ft projection TV screens in betting areas. Actual running of the race is also shown on the monitors and screens. The monitors are of the type designed for industrial or broadcast station applications with horizontal resolu-



**OUTPUT AND INPUT CIRCUITS** from PA amplifiers are contained in wireways for distribution to over 500 speakers throughout the track area.

tion in excess of 600 lines. A special illuminated board in the calculator room indicates odds and results through its connection to the totalisator equipment. This board posts the odds information on the left half, and the results on the right half. Each half requires a separate camera, and produces a picture of approximately four units wide by three units high (which is required for a suitable television image).

A multiple antenna system permits reception of commercial TV programs on conventional receivers in certain areas. Two combination receivers will select and receive either commercial or closed circuit telecasts.

Network TV cameras and crews operate from a platform on the press box roof. From an interior truck dock at ground level, a 12-in. square steel duct extends to the roof near the camera platform, and serves as a raceway for cables between the mobile unit and the camera. This eliminates unsightly exposed cables usually seen with network telecasts in sports arenas. Two 6-in. Transite conduits provide a cable raceway from the mobile unit to the winner's circle. A 75-kva transformer, mounted on the truck dock platform, supplies power for the TV mobile unit.

### **Totalisator System**

Highly important to the operation of a racing plant is the totalisator system. Impulses carry over the

miles of tote system cables, and switching racks interpret and relay the impulses to the tote board. There, the constantly changing lighted numbergrams reflect the betting mood of the racing fans. Over 3,000 ft of cable trays carry tote cables to the infield tote board and all mutuel sections. A 7-ft dia. pipe tunnel houses all electrical cables and connections to the tote board and stable area, across the track.

For the convenience of patrons, there are 11 odds boards in the betting areas. Odds and results are relayed over the closed-circuit TV system to monitors in the dining and lounge areas and to the screen projection TV units in the betting areas. In the tote equipment room, a 200-amp, 240-volt service supplies the tote company's 30-hp motor-generator set for conversion to their 48-volt dc supply system.

Each single face odds board has a 60-amp, 120-volt service; and a 150-kva unit substation serves the infield tote board from a vault below. In all, the tote system has a load of about 300 kva.

### **Photo Finish Camera System**

Photo finish equipment photographs the finish of each race, and cameramen process the film immediately. If a "photo finish" results, judges can quickly determine the winner and have the visual evidence to support their decision. Also, the picture may be transmitted over closed-circuit TV to patrons.

With the grandstand facing due east, daylight conditions at the finish line vary from race to race and change considerably from early spring meets through the racing dates in late November. To supplement daylight and assure a clear photograph at all times, four floodlights focus on the finish line from above the camera roof. These floodlights may be switched on or off from the camera room and positioned to cover the finish line of the dirt, turf or steeplechase tracks. Custom-made for race track use, each floodlight has a 10-kw, 120-volt lamp.

### **Track Circuits and Equipment**

Aluminum track rails for the dirt track also serve as raceways for the electrical circuits around the track. These circuits include judges' telephones, power for camera towers and teletimer circuits. The teletimer has an electric eye with beams at each  $\frac{1}{8}$ -mile post to record the elapsed time for the lead horse. Results total automatically and appear on the tote board.

### **Stable Area**

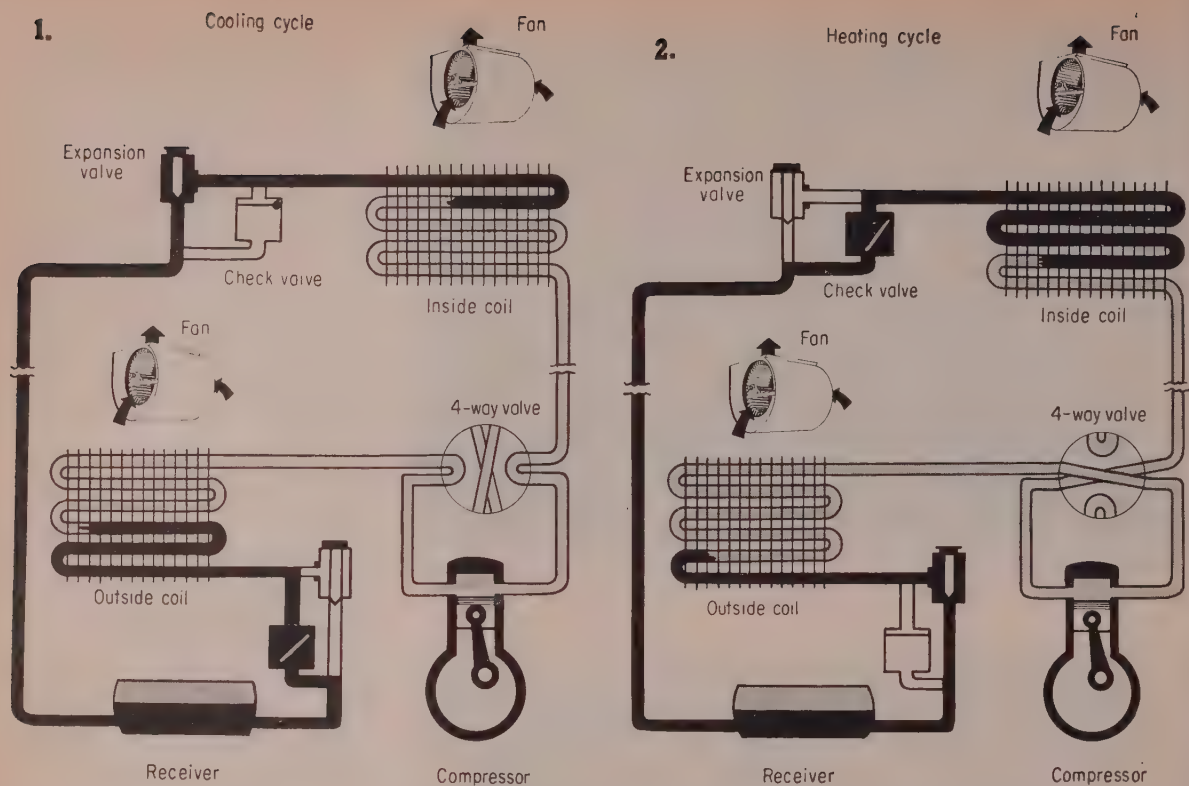
The stable area has accommodations for 500 horses in 13 stable buildings. Three of the buildings have dormitories on the second floor for 150 employees. Other buildings in the stable area include a blacksmith shop, cafeteria, recreation and maintenance buildings.

Two 150-kva and three 75-kva load centers serve the electrical needs of the stable area. A 4,160-volt feeder extends across the track to supply the load centers.

Horse stable buildings have a fire detection system with a combination rate-of-rise and fixed temperature detector in each stall and at intervals in the horse walks. Detectors connect into the main plant fire alarm and detection system.

NYRA retained Stone & Webster Engineering Corporation as project managers on the design and construction of this project. H. N. McCampbell, vice president, was in general charge. Others were R. H. Foss, project manager, H. V. Robichau, project engineer, and the writer was the electrical engineer. The general contractor was Caye Construction Company, and the electrical work was a joint venture of Fischbach & Moore, and T. Frederick Jackson, Inc.





**TYPICAL PIPING DIAGRAM** details heat pump operation for (1) cooling and (2) heating. Notice positions of 4-way valves, check valves and expansion valves in both the heating and cooling cycle diagrams.

## Bowling Plaza

Chicago's first all-electric bowling center features heat pumps for heating and cooling, an electric kitchen, electric water heating and electric heating cables in the sidewalks for snow melting.

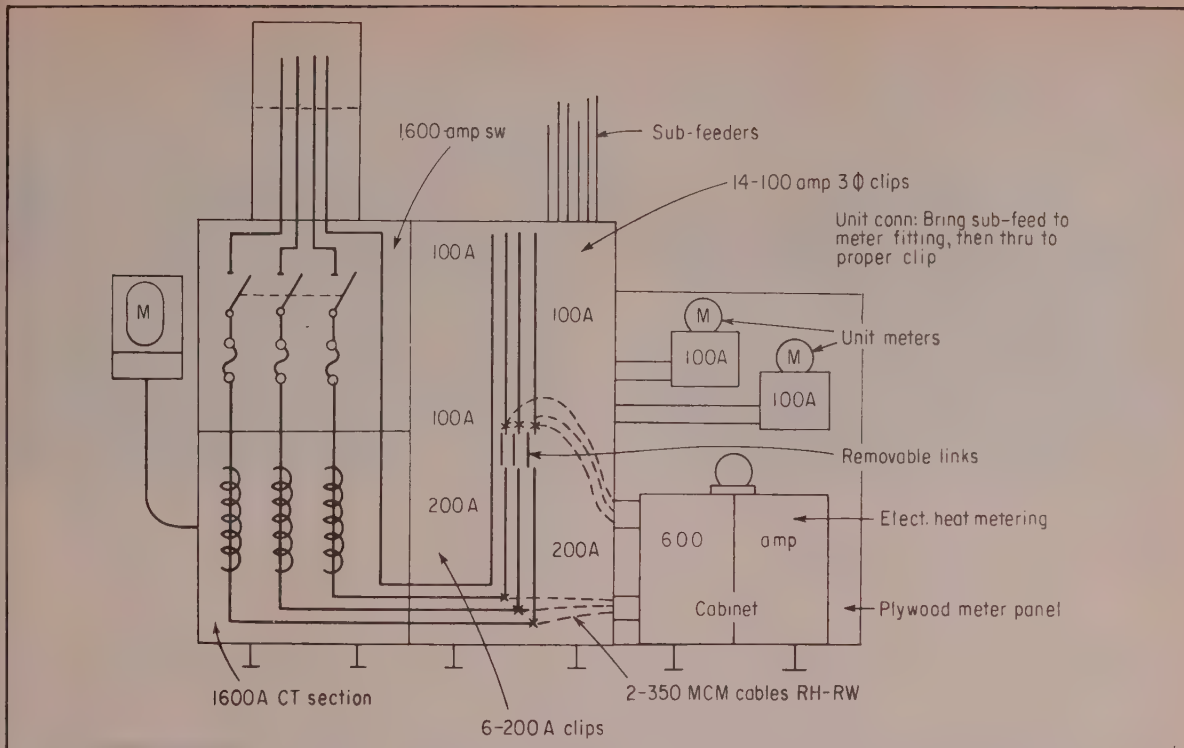
**P**ATRONS of the Palisade Bowl, a huge new Chicago bowling alley, are able to spend their leisure hours in a recreation center that is completely governed by electricity. First of all, they enjoy a comfort-conditioned atmosphere that is provided by a zoned controlled heat pump installation which constantly and automatically regulates the building's temperature and humidity. When they use any one of the center's 32 bowling lanes they find them equipped with electrically operated automatic pinsetters. Refreshments are served from a restaurant equipped with an electric kitchen—cocktails are available in decoratively lighted lounge. Row after row of fluorescent lighting

equipment provides daylight brightness over the 32 alleys. And in the washrooms there are electrically operated hand dryers. Even outside the building the use of electricity is widespread. It is used to brighten a large parking lot, to energize a huge neon sign and to melt snow and ice from the sidewalk entrance.

Installation of the air-to-air heat pump system in the 31,450 sq ft bowling plaza represents a significant development in the Midwest's current electric heating progress. The system, consisting of three 20 hp and two 10 heat pumps, whose compressors and condensing units are roof-mounted, supplies both heating and cooling for a total of 32 bowling lanes, a restaurant, cocktail

lounge, banquet hall and miscellaneous spaces.

Preliminary figures showed that considering all costs, including fixed charges on the investment, the annual cost of operating the heat pump system was estimated to be about 20% more than conventional heating and cooling systems. But, this seemingly additional cost was then offset by the following facts: (1) The heat pumps could provide a simple zone control that otherwise would require a complicated system. (2) Insurance rates would be less since there would be no combustible fuels involved. (3) A portion of the basement area originally designed to house a boiler, plus air conditioning equipment could be



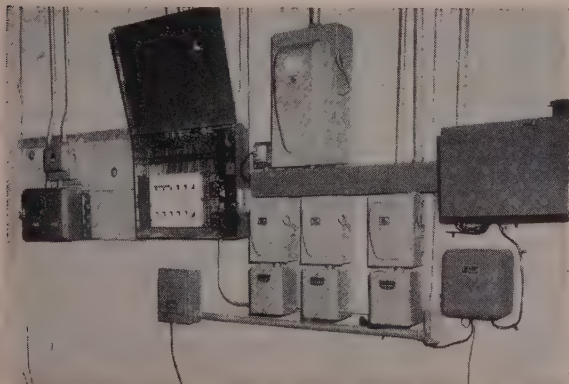
**SCHEMATIC DRAWING** of main service entrance panelboard lists 1600-amp main service switch, main distribution panel and metering equipment.

## Goes All-Electric

utilized to make a banquet hall practical. (4) Rent from the banquet hall (for bowling league meetings, etc.) could be expected to pay most (if not all) of any possible additional costs attributed to the heat pump system. (5) Since all bowling

alleys (with automatic pinsetters and proper lighting) are large users of electricity, it would be possible for the building owner to take advantage of lower steps in the block rate to operate the heat pump system. In this particular case, present

usage rate is in the 75 cents per kilowatt hour energy step, plus monthly demand charges. The above analysis was developed and presented to the owner by the utility. The wiring job was planned and directed by Irv Drucker, Irv Drucker

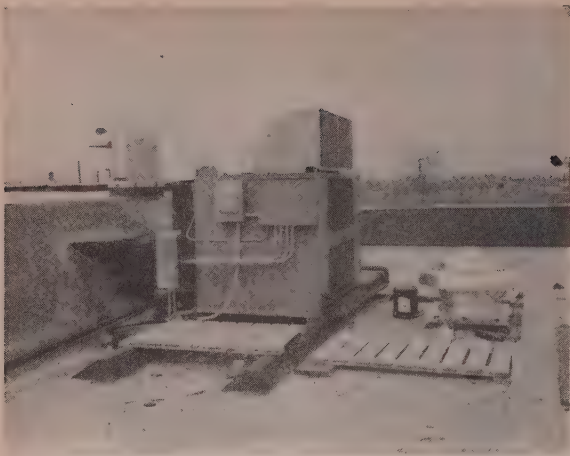


**CONTROL PANEL** features manually operated over-ride switches for governing air mixtures, ventilation and supplementary duct-type resistance heaters when adjustments to the pre-set running cycle are necessary because of adverse conditions, such as, excess smoke, etc.



**CLOSE-UP-VIEW** of supplementary blast coil heater installed in indoor air handling units. Coils are automatically energized whenever the second stage thermostats call for heat.





**TYPICAL** 20-ton heat pump unit. Notice exhaust air duct work from plenum chamber. By placing weatherproof units on the roof, engineers eliminated the need for an equipment room while also minimizing duct work runs.



**OVERALL VIEW** shows four of the five roof-mounted heat pumps that are an integral part of the air-to-air system serving the 31,450 sq ft bowling alley.

and Associates, Consulting Engineers, Chicago, and installed by Brown Electric Co., Chicago electrical contractors, technical assistance for the heating job was provided by Commonwealth Edison Co.

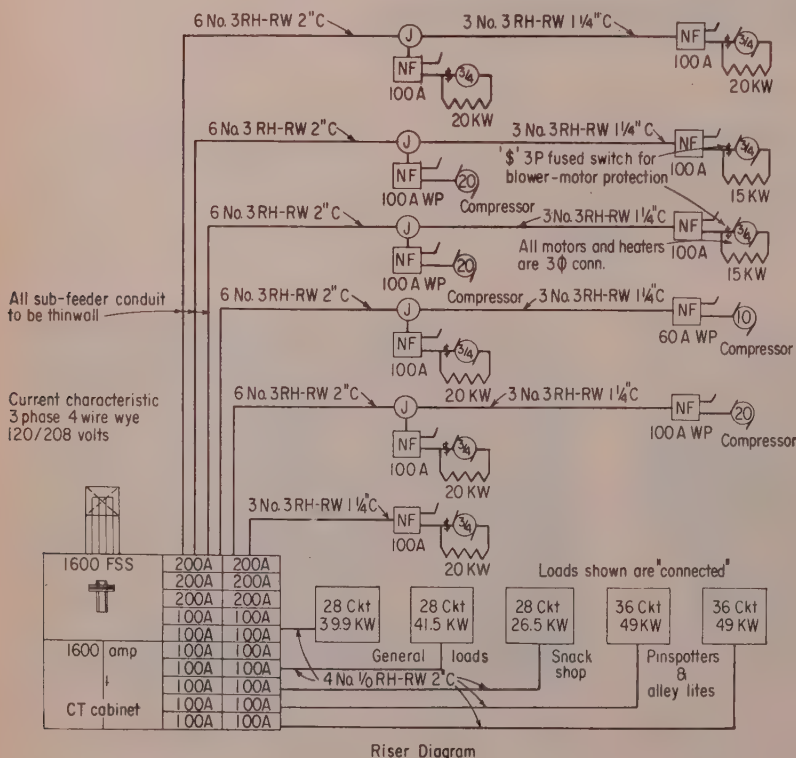
The functional air heating and cooling system is designed and engineered to take into all factors af-

fecting its efficient operation—such as: insulation and ventilation, building orientation, heat gained from lighting, from automatic bowling equipment and from physical activity. Major mechanical components of the system include: roof-mounted weatherproof compressors and condensers, heat transfer units

(commonly referred to as air handling or mixing units), eight duct type resistance blast heaters (totaling 150 kw), eight two-stage thermostats, damper controls for governing air mixtures, and exhaust fans for ventilation.

There are a total of eight indoor air handling units mounted throughout the building. Five of these units are installed directly above the bowling lanes in the truss section of the roof. Single units are suspended below the ceiling in the kitchen area of the restaurant, in a storeroom adjacent to the cocktail lounge and in a basement storage area alongside of the banquet hall. First stage heating is handled by the heat pumps which use a mixture (depending on weather condition) of fresh and return air. Normal control of the heat pumps' operation is provided by eight two-stage thermostats located as follows: five on the concourse, one in the snack bar, one in the bar, and one in the basement. When the demand for heat exceeds the first-stage setting of these thermostats, the resistance heating (blast heaters) installed in the eight indoor air handling units automatically cuts in.

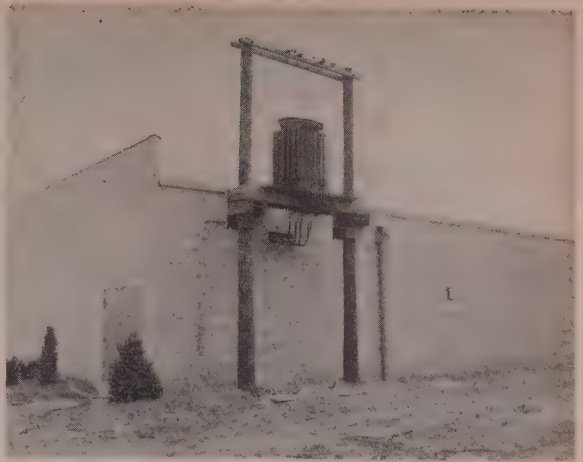
Automatic damper controls on fresh air intake and return air from the plenum chamber (the bowling plaza's roof area) control the mixture of fresh and return air. Normal ventilation is accomplished by time controlled exhaust fans which operate 4 minutes out of every 15, or a total of 16 minutes out of every hour. However, over-ride switches mounted in a control center can be



**SINGLE-LINE RISER DIAGRAM** details feeders to sub-distribution panels and heat pumps. All sub-feeder runs installed above ceiling are in EMT conduit.



**ONE OF THE REASONS** for justifying the installation of electric heat was the above banquet hall. With a conventional heating system a great deal of this space (45 ft by 70 ft) would have had to be used to house equipment and fuel.



**POWER SOURCE** for the all-electric bowling alley is this new and unusual 225 kva air-cooled transformer, platform mounted at the rear of the building. Also shown is the 1600-amp service bus head and the 100-amp emergency service conduit.

manually operated to decrease or increase these time limits depending upon conditions—such as; excess smoke, etc.

The exhaust air is passed through the outdoor section of the heat pump (the evaporator coil). Thus, the heat from the exhaust air is recaptured and pumped back to the alley improving the capacity and efficiency of the heat pump.

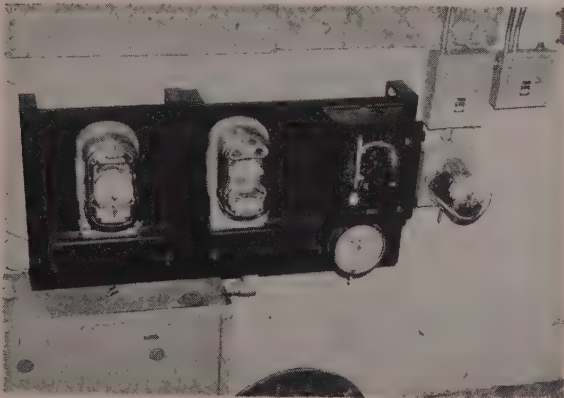
In order to prevent heavy coats of frost from forming on the roof-mounted condensing units, the heat pump system is equipped with automatic defrost timers that cycle 30 seconds out of every half-hour, or a total of one minute out of every hour.

Generally speaking the building is not as well insulated as most structures that feature electric heat.

This is due to the fact that the change from fossil fuel to electricity did not take place until after the outer shell of the building was completed. However, the building is insulated to the extent that heat losses are about one-third to one-half of those which prevail in a conventionally constructed bowling alley. The building's 12-in. thick side walls are constructed of 8 in. of lightweight concrete block plus 4 in. of face brick. There are 2-in. insulated batts installed over the entire ceiling above the bowling lanes. Over the concourse area, cocktail lounge, and restaurant 4 in. of mineral wool insulation was blown-in. At the rear of the building a 1-in. rigid insulation was installed from floor to ceiling.

In order to overcome cold blasts

of air at the three building entrances 24 kw of wall-type forced air resistance heaters were installed. When the heat pumps are used for summer air conditioning their main control is provided from the two-stage thermostats mounted on the concourse. Besides the heat pump system, the all electric bowling center features 4.4 kw of outdoor parking lot lighting; 13,500 watts of electric hand dryers; water heating is provided by one 7,000-watt and one 4,500-watt heaters; the outdoor sign load is 12 kw; sidewalk snow melting equipment totals 27 kw; there is a complete electric commercial kitchen, not to mention 96 kw of pinsetting equipment, including a fully automatic master control panel which governs each lanes' lighting and other equipment.



**EXTENSIVE METERING** equipment mounted above current transformer cabinet records demands on lighting (far left meter), heating (middle left meter), heating demand printometer (middle right meter), and emergency lighting (far right meter).



**SNOW MELTING** control center with contactors and time clocks govern 27 kw of underground sidewalk heating cable.



# 60,000-KVA Station

Serving state, county and city administrative buildings in Los Angeles' rapidly expanding Civic Center, large-scale transformer and switching station features novel oil-to-air heat exchangers incorporated in ventilation ducts, double-break disconnects for insured safety, also provisions for remote supervision and control. The Berg Electric Company was electrical contractor for the structure, with department forces installing all station equipment.

By Frederick B. Hyde, *Electrical Engineering Associate, Department of Water & Power, City of Los Angeles, Calif.*

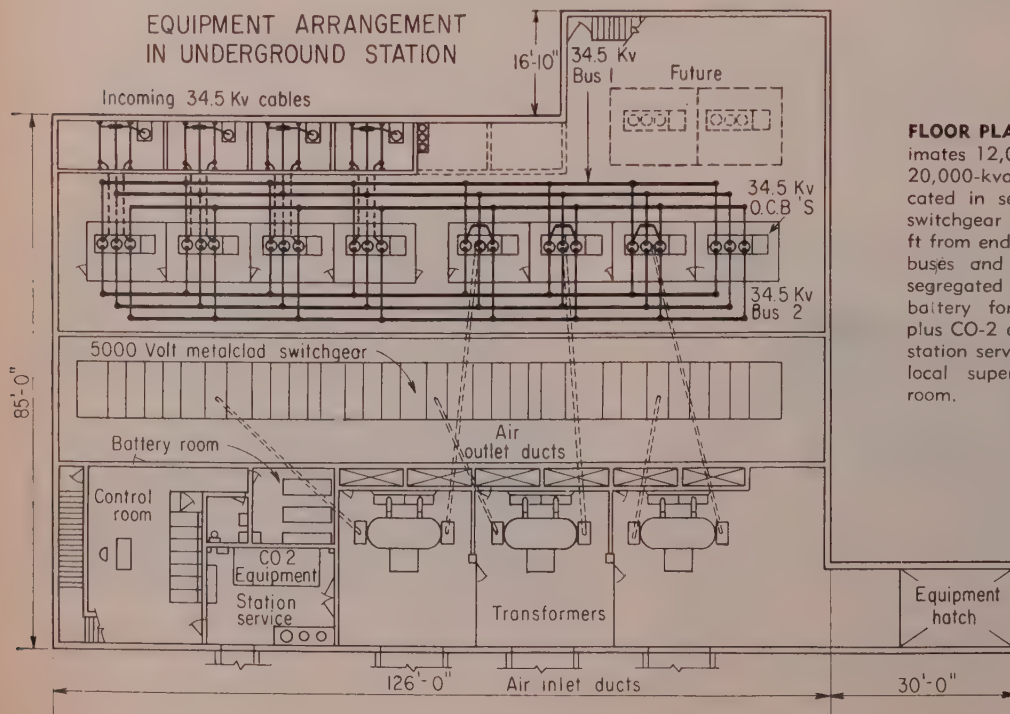
**A** DECADE ago downtown Los Angeles was electrically served by five utility distribution stations having combined ultimate capacities of 187,000 kva. However, due to development of a vast new Civic Center with concurrent erection or planning of more than a score of administrative

buildings related to state and county as well as to city government, and other load increases in the area, it was decided to construct a new 60,000-kva station as near as possible to the electrical load center of this new Civic development, and to serve all new buildings in the Center through relatively short

underground feeders radiating from the new station.

Indications were that this overall radial plan would result in substantially lower distribution costs than would be obtainable with either a primary or secondary network system, and that (with short feeders serving an area of moderate load density) satisfactory voltages could be maintained by considering regulation as a central bus (rather than as an individual feeder) problem. This solution likewise would result in desirable capital savings.

Upon plotting the load center geographically, it was found to fall close to an important traffic intersection, where Broadway overpasses the Santa Ana Freeway. And, since the Freeway is deeply depressed and attractively landscaped through this part of the city, it was apparent that a surface structure would involve considerable foundation work plus a high order of architectural treatment to conform with general surrounds as well as with design standards established by a Civic Center Authority.



**FLOOR PLAN** of station approximates 12,000 sq ft, with three 20,000-kva transformers located in separate vaults, 5-kv switchgear extending over 100 ft from end-to-end, high-voltage buses and circuit breakers in segregated area, and storage battery for breaker operation plus CO-2 equipment located in station service room adjacent to local supervisory and control room.

# Goes Underground

Thought was therefore directed towards construction of an underground station, for it was evident that, due to the proximity of the deeply depressed freeway, (1) excavation costs related to an adjacent underground structure would be less than normally expected. Moreover, by going underground, (2) architectural problems would be bypassed and (3) comparative construction costs would be reduced between 5% and 20%, depending upon whether the comparison was made with either a plain tilt-up wall-enclosed control house or with a more-elaborate 2-story building of acceptable design.

Another consideration was that, with the station placed underground, the structure could be covered with topsoil and attractively landscaped, thereby obtaining an aesthetic appeal, while added elements of concealment and protection would be realized should cases of disaster ever develop. Inasmuch as the station was being planned to also take care of police and civilian defense electrical needs, this insurance against power interruption

was considered to be a factor of some importance.

## Oil-Air Heat Exchangers

Still another advantage would accrue to this underground placement, for the sloping banks on the freeway side would make it possible to install flush-entrance horizontal ducts through which forced air could be conducted for transformer-cooling purposes, warm air then being exhausted upwards through vertical shafts having ground-level vents which could be concealed by attractive plant arrangements on the overhead terrace.

As subsequently developed, each of the three installed 20,000-kva transformers were equipped with two oil-to-air heat exchangers, one of which remains in continuous service when the related transformer load is normal (that is, 13,333 kva or less), while the second heat exchanger is automatically placed in operation when the necessity for additional cooling is registered by hot-spot detectors.

In this cooling cycle, fresh air is drawn into separate transformer vaults through the horizontal intake ducts; then it passes around the transformers, through the heat exchangers and is finally exhausted to the atmosphere through the vertical ducts. Conjunctionally, oil in the heat exchangers is continuously pump-circulated through flexible connectors to transformer tanks.

In addition to these three independent cooling systems related directly to the transformers, a fourth system is provided to circulate air generally through the remainder of the station.

Space above transformer oil is filled by nitrogen gas kept at  $\frac{1}{2}$  psi pressure by automatic gas regulators.

## Liberal Spare Capacity

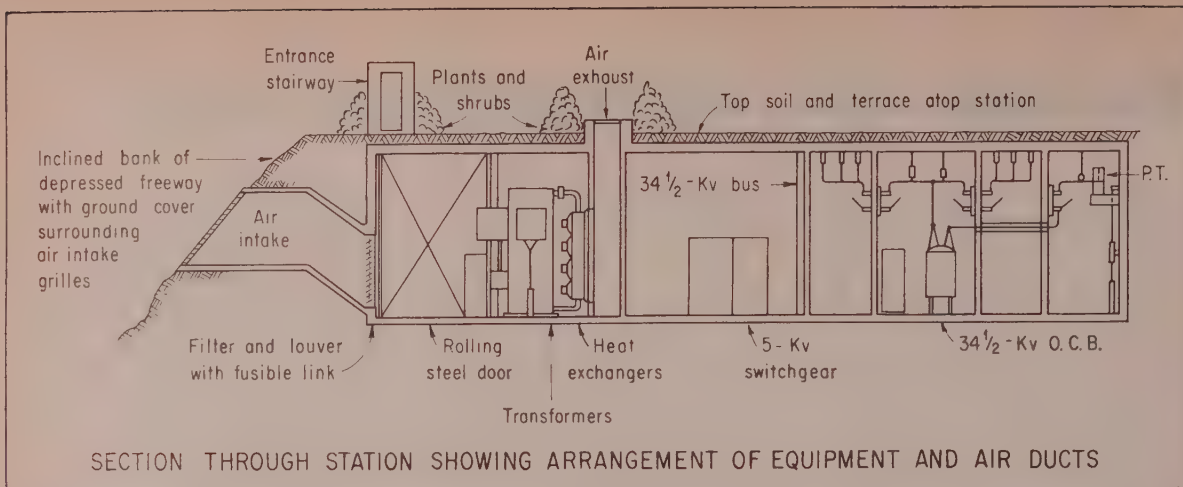
The three 20,000-kva, 3-phase, 34.5-kv primary and 5-kv secondary transformers are located in separate compartments. And, with a normal station load of 40,000 kva, each unit could easily carry a third of that demand. Or, should one



**AIR INTAKE GRILLES** of underground transformer and switching station are set flush with sloping bank alongside traffic-jammed Santa Ana Freeway; made inconspicuous to passing motorists by attractive growth of ivy. Small structure seen in extreme upper left hand corner houses entrance stairway.

**LANDSCAPE TERRACE** above station roof is likewise planted with shrubs that conceal exhaust air grilles supported on low concrete curb-collars. Stairway entrance building seen in rear, plus similar emergency exit out of camera sight at right, are the only above-ground details of station visible to pedestrians or motorists.





**CROSS SECTION** shows sub-surface construction beneath landscaped terrace and inclined bank adjacent to depressed Santa Ana Freeway. Attractive ground covers, plants and shrubs shield air intake and exhaust ducts from public view. Under-

ground construction also eliminated architectural problems and provided element of safety and concealment for this important electrical facility.

transformer be taken out of service for maintenance, repair or rest periods, the two remaining units could carry the full station load by assuming their nominal rated capacities.

Each transformer supplies a normally isolated group of six 5-kv feeders, with voltage commonly regulated through switching of load-tap-changing equipment. And, since all 18 5-kv feeders are short in length and serve loads with similar characteristics, this method of voltage regulation is proving to be quite satisfactory while (compared with overhead lines) reactance of feeders is of a low order.

Should any abnormal conditions develop (such as low oil level, high oil temperature, high or low nitrogen gas pressure or low pressure in the nitrogen supply cylinder) alarms would sound locally and would also be transmitted by a supervisory indication system to a remote control station to advise the dispatcher of developing conditions warranting his prompt attention.

Primary 34.5 kv service for this station is provided through four 3-conductor 750-MCM paper-insulated lead-sheathed low-pressure gas-filled copper cables, likewise equipped with alarms to indicate loss of gas pressure. Main circuit breakers are conventional oil-filled 1200-amp units having 1½-million-kva interrupting capacity.

### Double-Break Disconnects

In both line and transformer positions, double-break disconnect

switches rated at 600 amps are employed. This double-break design means that blades are not at bus potential when switches finally open; therefore definite safety features are obtained. In addition, all 34.5-kv disconnects are interlocked with circuit breakers so that line-side disconnects cannot be opened until related breakers are likewise in the open position. Conversely, bus-side disconnects can-



**HEAT EXCHANGERS** (located directly behind related transformers) pump-circulate oil through flexible connections to transformer cooling system, while heat of liquid is dissipated by fan-forced fresh air which is drawn into station through ducts opening on freeway embankment, then exhausted upwards through stacks opening flush with overhead landscaped terrace.

not be opened unless the bus-tie breaker and its associated disconnect switches are closed.

Connections between power service entrances and transformers are effected through 3-conductor 500-MCM cables similar in design to the 34.5-kv primary incoming line cables, while each phase of the 34.5-kv bus structure consists of a single 1½-in. copper tube supported by post insulators.

All secondary 5-kv switchgear equipment, including buses, load interrupting transfer bus disconnects, electrically operated horizontal draw-out magnetic-air circuit breakers, etc., is contained in a single row of conventional metal-clad cubicles. Current ratings for 5-kv main and transfer buses are 2000 and 1200 amps, respectively. Transfer bus load-interrupter disconnects (having continuous ratings of 600 amps with interrupting capacity of 400 amps at 5-kv and 70% PF) are gang-operated.

Spare breakers of each size are conveniently available for purposes of routine maintenance and rotation, while replacement of 5-kv units may be accomplished without interrupting service by switching the load to the transfer bus during that operation. Also, for maintenance, cable or phasing tests, a grounding and testing device may be inserted into any feeder cubicle to effectively ground the feeder when its draw-out breaker is not in position.

Since the station is normally unattended, all operations pertaining to 34.5-kv breakers, 5-kv trans-

former and bus-tie breakers, also to transformer load-changing taps are indicated by appropriate signals and tell-tale lamps at a remote supervisory and control station. At this distant station, all abnormal conditions are announced by related alarms, while telemetering equipment is used to inform the remote dispatcher of phase-to-phase voltage on incoming 34.5-kv lines as well as secondary current, voltage and power of transformers.

Of course, all breakers normally so operated remotely can also be controlled locally through the medium of miniature switches on the station's local supervisory board. This design, by eliminating four full-scale control panels, greatly reduces the cost of control equipment and also provides the facilities for convenient local operation of equipment.

Power to operate this supervisory control equipment, as well as for tripping breakers, operating relays and providing emergency lighting, is provided by a 125-volt 60-cell lead-calcium storage battery rated for 240 amp-hours and kept at full potential by a mag-amp-regulated selenium rectifier charger.

### Station Plan and Construction

As to the physical characteristics of this underground station, the waterproofed, reinforced-concrete structure has an 85- by 126-ft basic floor plan with an 18-ft clearance to the roof slab which, in turn, is covered by 12 in. of topsoil for ornamental plantings above. Air intake and outlet ducts are inconspicuously placed among ground coverings and bushes; the only visible signs of the station being two small structures that enclose entrance and emergency exit stairways, plus a ground-flush hatchway adjacent to an upper parking area through which station equipment can be raised or lowered.

Cubicle assembly for 5-kv switchgear extends 102 ft from end-to-end; a sub-floor trench underlies the entire assembly to contain control circuiting, and an aisle placed at the mid-point facilitates cross-station inspections.

The installation and connection of all power equipment was by Department of Water and Power personnel, Berg Electric Company installing all related conduit plus wiring, panels and lighting fixtures associated with the building structure.



**METAL-CLAD 5-KV SWITCHGEAR** measures over 100 ft from end to end with an underfloor trench extending for the entire length of this free-standing cubicle arrangement to contain control wiring and feeder circuits. Narrow separation at midpoint of assembly provides walk-through space for maintenance personnel.



**DISCONNECTS IN 34.5-KV BUS** structures are double-break units related to oil circuit breakers. Since station is normally unattended, position of these breakers, as well as 5-kv transformer and bus-tie breakers, is indicated by appropriate signals and pilot lights located at remote supervisory and control station where abnormal conditions are announced by related alarms.

This station, although related to the service of a major metropolitan civic center, indicates that underground placement of transformer and switching facilities is also feasible for smaller-in-scope or privately financed installations. For, with its plus-values of attractive landscaping, inconspicuous appearance, economical construction, reliability, unattended operation with

remote supervision and many safety features, it suggests possible duplication for college campuses, residential sections or attractive commercial ventures in semi-residential areas.

With the greater need of increased power facilities in all urban areas, this station stands as a practical example as to what can be done to solve the problem elsewhere.



# Safe Billing Practice

Faulty billing can lose accounts. How to apply proper overhead and bill as to type and size of project is discussed below.

By Ray Ashley, *Research and Consulting Engineer  
Oak Park, Ill.*

**A** REGULAR customer is one of the most valuable assets an electrical contractor can have. Occasionally, a contractor should slow down a bit in his race for new business and study his already established connections to see if he is making the most of them.

Regular customers can be lost and such loss is of vital consequence to the contractor. When this occurs, the first question asked is "Could this loss have been avoided?" Often,

the answer is "Yes." Research and experience have indicated that faulty billing has been the prime reason for losing many accounts. Either the bill (or statement) was not comprehensible to the customer, or was too high for the type of work done.

*Comprehensive Billing.* While this article will discuss the practice of billing according to the type and size of the project it might be well to review some of the background

of comprehensive billing. Such billing statements should have the following features:

1. Direct job expenses listed as such and not included in overhead.
2. Material markups consistent with the cost of supplying material, and not designed to carry part of the labor burden.
3. Labor markups commensurate with the cost of supplying labor.
4. Markup for return (profit) not excessive. It is not designed to cover shortage in overhead markup.
5. The breakdown shows the total as the aggregate of small charges.
6. The contractor issuing the statement should make sure the customer understands all the charges.

## Correct Billing

The contractor has two types of customers: 1) the regular buyer; and 2) the occasional buyer. Typical regular buyers are industrial or commercial institutions that regularly supply contracts without competition. The occasional buyer might include the architect, engineer or other type who keeps the contractor on his bidding list and awards a contract if and when the bid is inviting.

*The Regular Buyer.* Billing practices for the regular buyer must be studied most carefully. There are no fixed rules for such billing. The contractor must study each account so he can establish and apply markups suitable to the contracts received.

Fig. 1 shows representative overhead costs for contracts ranging from \$100 to \$9,000, and complying with certain stipulated conditions. The values are for isolated competitive jobs with an M/L ratio of 60/40 (60% material, 40% labor). The regular buyer belongs in a different class and often rates lower markups.

### EXAMPLE I.

#### NORMAL OVERHEAD AND COMMON MARKUP

|                   |                               |
|-------------------|-------------------------------|
| Material.....     | \$540.00 (60%)—job cost incl. |
| Labor.....        | 360.00 (40%)—job cost incl.   |
|                   | <hr/>                         |
|                   | 900.00                        |
| Overhead.....25%  | 225.00                        |
|                   | <hr/>                         |
|                   | 1125.00                       |
| Profit.....10%    | 112.50                        |
|                   | <hr/>                         |
| <b>Total.....</b> | <b>\$1237.50</b>              |

### EXAMPLE II.

#### ADJUSTED OVERHEAD AND SEPARATE MARKUP

|                              |                           |                  |
|------------------------------|---------------------------|------------------|
| Material.....                | \$540.00 (job cost incl.) |                  |
| Overhead (material)....10%   | 54.00                     |                  |
|                              | <hr/>                     |                  |
|                              | 594.00                    |                  |
| Return.....5%                | 29.70                     |                  |
|                              | <hr/>                     |                  |
| <b>Total (material).....</b> |                           | <b>\$623.70</b>  |
| Labor.....                   | \$360.00 (job cost incl.) |                  |
| Overhead (labor).....35%     | 126.00                    |                  |
|                              | <hr/>                     |                  |
|                              | 486.00                    |                  |
| Return.....10%               | 48.60                     |                  |
|                              | <hr/>                     |                  |
| <b>Total (labor).....</b>    |                           | <b>\$534.60</b>  |
|                              | <hr/>                     |                  |
| <b>Total (the job).....</b>  |                           | <b>\$1158.30</b> |

# ESTIMATED OVERHEAD To be Allotted to Individual Jobs According to Job Costs

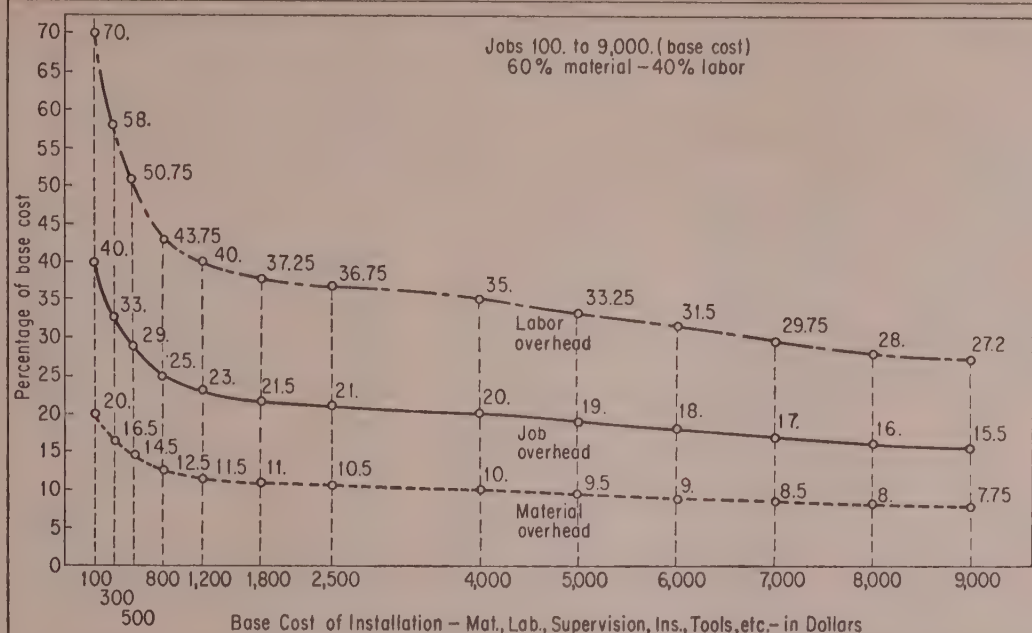


**FIG. 1**—Estimated overhead percentages to be applied to competitive type work. Non-competitive work for regular customers rates lower markups.

There are several reasons for this. Work from a regular buyer does not entail the same expense as isolated projects obtained in the competitive field. Estimating cost is limited and there is little or no sales expense. Orders are so "regular" that one job often moves right into the next. At times, the total of several small orders equals a large contract.

Let's study a hypothetical case. Assume that a customer gives a contractor 20 orders a year totaling \$18,000 (base cost). This would average some \$900 per order. Normal job overhead (Fig. 1) for a \$900 contract is approximately 24% (12% on material and 41% on labor). Studies indicate that, for this regular type of business, an overhead figure for a job two or three times the average size could be used. Take twice the average job size, or \$1,800. Fig. 1 shows the job overhead for this size contract to be 21.5% (11% on material and 37.25% on labor). Thus, by using twice the average contract volume, job overhead is reduced from 24% to 21.5%.

Contractors like to stay away from odd percentages. In the above case under favorable conditions, chances are that a contractor would use 10% for material and 35% for

labor. With a 60/40 material-labor ratio, the resultant job overhead markup would be 20%.

Fig. 2 shows the effect of applying the reduced overhead to 20 contracts totaling \$18,000. Column II lists the normal overhead percentage applied to isolated jobs of the size indicated. Column IV lists the overhead for jobs twice that actual size. For example: the first contract for \$800 has a 25% overhead (Col. II) which is normal for that size job. The 22% in Col. IV on the same line is the normal job overhead for twice that amount, or \$1,600.

The Study of Overhead Costs for Billing Regular Customers in Fig. 2 presents some interesting figures for the \$18,000 total volume of 20 jobs.

With normal overhead applied to each job (Col. II), the total overhead is \$4,505. This is about 25% of the \$18,000 volume.

With reduced overhead applied to each job (Vol. IV), the total overhead is \$3,660. This is slightly over 20% of the \$18,000 volume.

Actual difference between the two overhead methods is \$905 for the \$18,000 volume.

In practice, contractors might prefer to use the same markup for all billing. If the reduced overhead

for the average job (overhead for \$1800 applied to the \$900 average job) were used, the overhead percentage would be 21.5. To avoid odd figures, and under favorable conditions, a 20% markup would be applied (10% on material, 35% on labor).

With the special overhead of 20% applied to each job listed in Fig. 2 the total overhead would be \$3,600 for the \$18,000 volume.

## Types of Markup

In a story, the figures are not startling enough to impress. In practice, they are more effective. To augment the foregoing, two types of billing can be prepared for the average \$900 project:

1. Common Markup (Example I) based on normal experienced overhead.

2. Adjusted Individual Markups. While the normal job overhead for a \$900 contract was listed as 24% (Fig. 1), the contractor would more than likely use 25%. Example I gives the impression that the material is carrying a burden of 25%. It does not indicate that this 25% is not sufficient to cover labor costs.

Example II uses adjusted overhead (10% on material, 35% on labor) and separate markup on the



## A STUDY OF OVERHEAD COSTS

For Billing Regular Customers

| Order<br>Numbers | APPROX.<br>BILLING | ESTIMATED OVERHEAD |         |          |         |
|------------------|--------------------|--------------------|---------|----------|---------|
|                  |                    | NORMAL             |         | REDUCED* |         |
|                  |                    | %                  | Dollars | %        | Dollars |
|                  | I                  | II                 | III     | IV       | V       |
| 754              | 800.               | 25                 | 200.    | 22       | 176.    |
| 755              | 400.               | 30                 | 120.    | 25       | 100.    |
| 756              | 2,800.             | 20.5               | 754.    | 18.5     | 518.    |
| 757              | 450.               | 30.                | 135.    | 24.      | 108.    |
| 758              | 700.               | 26                 | 182.    | 22       | 154.    |
| 759              | 650.               | 27                 | 176.    | 22.5     | 146.    |
| 760              | 600.               | 28                 | 168.    | 23       | 138.    |
| 761              | 4,600.             | 19.5               | 897.    | 15.4     | 708.    |
| 762              | 600.               | 28                 | 168.    | 23       | 138.    |
| 763              | 200.               | 35                 | 70.     | 30       | 60.     |
| 764              | 400.               | 30                 | 120.    | 25       | 100.    |
| 765              | 300.               | 33                 | 99.     | 28       | 84.     |
| 766              | 450.               | 30                 | 135.    | 24       | 108.    |
| 767              | 300.               | 33                 | 99.     | 28       | 84.     |
| 768              | 400.               | 30                 | 120.    | 25       | 100.    |
| 769              | 450.               | 30                 | 135.    | 24       | 108.    |
| 770              | 500.               | 29                 | 145.    | 23.5     | 118.    |
| 771              | 400.               | 30                 | 120.    | 25       | 100.    |
| 772              | 800.               | 25                 | 200.    | 22       | 176.    |
| 773              | 2,200.             | 21                 | 462.    | 19.8     | 436.    |
| Totals           | 18,000.            |                    | 4,505.  |          | 3,660.  |

\* Overhead used was for job twice as large as shown in Col. I

FIG. 2—Reduced markups for overhead applicable to regular customers' work and billing are suggested in Col. IV. Markups for competitive work of similar nature are shown in Col. II.

same \$900 job. This method shows a true cost picture and should gain preference because:

1. The true charges can be substantiated.

2. Experience has shown that true markups (low on material, higher on labor) get a better acceptance than a common markup which represents the total job cost.

Remember that each contractor must establish his own experienced overhead costs. Studies like those in Fig. 1 and Fig. 2 should be used only as guides. The contractor's individual studies must be complete. A little knowledge of operating costs has often proved dangerous. The following actual case is cited to emphasize this point.

### How to Lose Customers

Overhead figures, whether they be guideposts developed by research and study or individually established units, should be applied with caution and considered judgment. A long-established electrical contractor learned this the hard way, after he had lost a number of good steady customers. Here's what happened.

For years, the contractor had used established markups of ap-

proximately 15% for overhead and 10% for profit. Then, near the end of one year's operation, he became quite overhead-conscious. After making what he considered a careful study of his overhead, he decided his experienced overhead was 40%. Immediately, he began to add 40% and 10% to all his statements regardless of type or size of job being billed. He convinced himself that it cost him 40% to operate and he insisted that he must add this much to his cost. Soon customers began to drop by the wayside, including a number of his better industrial accounts.

An impartial analysis of his operation and his own thinking uncovered these fallacies:

1. The 40% figure was not all overhead. It included many direct job expenses, some of which already had been charged to the work.

2. Included in the 40% was the upkeep of a small store and repair shop and the overhead for many small maintenance and repair jobs.

3. His original markups of 15% and 10% were misleading. The true figures should have been more like 21% for overhead and 5% for profit.

4. In billing, no consideration was given to the reduced cost of

serving regular customers who supplied large volumes of noncompetitive work.

Other cases have been reported where contractors had billed themselves out of customers. The actual billing may not have been excessive, but the method of presenting the statement was wrong and the customer did not understand that the charges were just.

Losing a customer can have quite a demoralizing effect on the contractor. Often, this is harder to take than the financial loss. Monetary losses on specific projects and losses of contracts in competition may soon be forgotten. Loss of a good steady account, on the other hand, is a memory that lingers a long time. Frequently a steady customer has become a good friend and such loss is doubly felt.

*Occasional Buyers.* Architects and engineers have been classed as occasional buyers. Their contracts are usually awarded on a quoted fixed-price basis for the main project. Extra work often follows. If the "extras" are given on a cost-plus basis, the billing requires the same consideration and care as that for regular customers.

There are salesmen, manufacturers, mechanics and others who feel that their personal interests will be served best if they can persuade owners (customers) to buy materials direct and hire mechanics to make the installation. Where competent electrical contractors are available, there are few, if any, instances where owners can benefit by trying to do their own work. This hazard is present and the contractor must do all he can to combat it. Careful billing practice is one of his most effective weapons in this respect.

It would be gratifying if a contractor's honest efforts always were fully rewarded. We know that such is not the case. In spite of all one can do, changing times and conditions will bring about losses. We know that a majority of the better contractors have built their business on a reputation of honest and careful treatment of customers. An operation based on that premise, and periodically analyzed with that in mind, provides the best type of customer service. Should losses occur, chances are that they are beyond the contractor's control and search for a solution must be carried beyond the boundaries of his own organization.

**TABLE I—EFFECT OF FLUORESCENT “WHITES” ON INTERIOR PAINT COLORS**

| Paint Color    | Munsell Color Designation | *Approx. Reflectance Factor | Incandescent Filament | Warm White Fluorescent  | Soft White Fluorescent | White Fluorescent    | Std. Cool White Fluorescent | Daylight Fluorescent  | Warm White Deluxe Fluorescent | Cool White Deluxe Fluorescent |
|----------------|---------------------------|-----------------------------|-----------------------|-------------------------|------------------------|----------------------|-----------------------------|-----------------------|-------------------------------|-------------------------------|
| Cherry Red     | 5-OR 4/14                 | .13                         | Brilliant Orange Red  | Pale Orange Red         | Pinkish Red            | Pale Orange Red      | Yellowish Red               | Light Red             | Orange Red                    | Good Match                    |
| Orchid         | 10-ORP 7/8                | .44                         | Light Pink            | Pale Purplish Pink      | Dusky Pink             | Gray Pink            | Light Pink                  | Good Match (Grayer)   | Pale Pink                     | Light Pink                    |
| Plum           | 10-ORP 2/2                | .04                         | Deep Orange Red       | Dull Reddish Brown      | Reddish Purple         | Dark Brown           | Light Reddish Brown         | Deep Bluish Purple    | Reddish Purple                | Darker Brown                  |
| Chestnut Brown | 7.5YR 5/2                 | .19                         | Medium Yellow Brown   | Light Yellow Brown      | Pinkish Brown          | Gray Brown           | Light Brownish Gray         | Light Gray            | Dark Brown                    | Good Match                    |
| Peach          | 2.5YR 8/4                 | .58                         | Pinkish Yellow        | Light Yellowish Pink    | Light Pink             | Light Yellowish Pink | Very Light Pink             | Fair Match (Lighter)  | Light Orange                  | Good Match (Yellower)         |
| Orange         | 5-OYR 7/8                 | .44                         | Bright Orange         | Light Orange Yellow     | Light Pink             | Pale Yellow          | Light Yellow                | Gray Yellow           | Yellowish Orange              | Good Match                    |
| Canary Yellow  | 10-OYR 7/8                | .44                         | Orange Yellow         | Fair Match (More Vivid) | Light Orange Yellow    | Greenish Yellow      | Light Yellow                | Fair Match            | Good Match                    | Good Match (Brighter)         |
| Light Yellow   | 2.5Y 8/8                  | .58                         | Vivid Orange Yellow   | Medium Yellow           | Pinkish Yellow         | Medium Yellow        | Light Bright Yellow         | Light Greenish Yellow | Deep Yellow                   | Bright Yellow                 |
| Light Blue     | 5-OBG 7/4                 | .46                         | Light Yellowish Green | Pale Grayish Blue       | Light Bluish Gray      | Weak Greenish Blue   | Blue Gray                   | Fair Match (Lighter)  | Grayish Blue                  | Grayish Blue                  |
| Medium Blue    | 5-OPB 5/10                | .23                         | Blue Green            | Light Gray Blue         | Weak Gray Blue         | Purplish Blue        | Light Gray Blue             | Fair Match (Lighter)  | Purple Blue                   | Reddish Blue                  |
| Silver Gray    | 2.5Y 8/2                  | .57                         | Light Yellow Gray     | Light Yellowish Gray    | Pinkish Gray           | Light Brownish Gray  | Very Light Gray             | Bluish Gray           | Yellowish Gray                | Light Gray                    |

Samples under the eight illuminants compared with identical samples under a Macbeth Daylighting Unit (color temperature 7000 K). “Good Match” indicates that the color of the sample so designated most nearly matches the standard under the Macbeth Unit. The footcandle intensity of all illuminants was approximately the same.

The Munsell designations are approximate, and were determined under the Macbeth Unit.

\*For Standard ICI Illuminant C, representative of average daylight.

Color nomenclature in accordance with ISCC-NBS System of Color Designations.

## Applications for the

# Fluorescent “Whites”

These recommendations provide a convenient guide for the selection of the appropriate “color” of fluorescent lamps for a variety of lighting applications.

**By Robert L. Zahour, Lamp Division**  
Westinghouse Electric Corp., Bloomfield, N. J.

**T**HE electric lamp industry makes seven different “white” fluorescent lamps. These lamps are available for the various lighting applications but present a problem in that a selection must be made. While the consumer, or his agent—electrical contractor, lighting consultant, engineer, or architect—has a choice, experience indicates that

the Deluxe Cool White or the economical standard Cool White can fill the needs best in stores, schools, offices and industrial plants. By using the other whites, however, these can be specifically selected to make a lighted area seem cooler in summer, and warmer in winter.

The color appearance of the seven white fluorescent lamps, and their

color rendition wherever used, is still confusing to many people. As an aid in clarifying the color qualities of each of these lamps and the differences between them, a description of each is presented here, including the areas for which each is particularly applicable.

**Standard Cool White**—This is the most widely used fluorescent lamp color in lighting today. Its name comes from the cool, airy atmosphere it creates wherever it is used. Modern, efficient and business-like, in a store it highlights products of all colors as well. It is also popular for classrooms, offices, corridors, and in factories.

**Deluxe Cool White**—This lamp looks like the standard cool white, but it has a richer color quality of



# TABLE I—APPLICATIONS

| AREA                                    | APPLICATION                                     | SUGGESTED LAMPS                                                                                            | EFFECT                                                           |
|-----------------------------------------|-------------------------------------------------|------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| SUPER<br>MARKETS<br>&<br>FOOD<br>STORES | General Lighting                                | Standard or Deluxe Cool *<br>White Fluorescent                                                             | Clean, efficient store<br>appearance                             |
|                                         | Poultry, Baked<br>Goods and Cheese              | Standard or Deluxe Warm *<br>White Fluorescent                                                             | Improved, more appetizing<br>colors                              |
|                                         | Meat Department                                 | Deluxe Cool White *<br>or Soft White Fluorescent plus<br>Incandescent spots                                | More appealing color,<br>fresher                                 |
|                                         | Fruits and<br>Vegetables                        | Standard or Deluxe Cool White *<br>Fluorescent plus Incandescent Spots                                     | Greener greens, more<br>attractive colors                        |
|                                         | Packaged and<br>Canned Goods                    | Standard or Deluxe Cool White *<br>Fluorescent with rack Lighting                                          | Maximum visibility and<br>appeal for labels                      |
|                                         | Feature Displays                                | 75-Watt R-30 Spot or Flood<br>150-Watt R-40 Spot or Flood<br>300-Watt R-40 Spot or Flood                   | To focus attention on specials<br>and fast-moving feature items  |
| CLOTHING<br>STORES                      | General Lighting,<br>Men's Wear                 | Standard or Deluxe Cool White *<br>Fluorescent Deluxe Cool White *<br>for mirrors.                         | Cool, crisp atmosphere,<br>maximum visibility for<br>displays    |
|                                         | General Lighting,<br>Women's Wear               | Deluxe Cool * or Warm White *<br>Fluorescent—Deluxe Cool White *<br>for mirrors.                           | Warm, complexion-flattering<br>light                             |
|                                         | Fitting Rooms and<br>Fabric Displays            | Deluxe Cool White * Fluorescent                                                                            | Best color appearance for<br>fabrics                             |
|                                         | Window and<br>Feature Displays                  | 75-Watt R-30 Spot or Flood<br>150-Watt R-40 Spot or Flood<br>300-Watt R-40 Spot or Flood                   | Extra attention to<br>featured styles                            |
| BARBER SHOPS &<br>BEAUTY SALONS         | General Lighting                                | Standard or Deluxe Cool White *<br>Fluorescent                                                             | Cool, pleasant light                                             |
| INDUSTRIAL<br>(Fairly Clean<br>Areas)   | General Lighting<br>(Low & Medium<br>Bay Areas) | Cool White Fluorescent<br>Daylight Fluorescent in<br>Southern Climes                                       | Satisfactory work Light<br>Psychologically cool Light            |
|                                         | General Lighting<br>(High Bay Areas)            | 1500 MA Cool White Fluorescent<br>400 Watt Mercury Lamp<br>700 Watt Mercury Lamp<br>1000 Watt Mercury Lamp | Good lighting from high<br>mounted concentrated<br>light sources |
|                                         | Local Lighting                                  | 75 Watt R-30 Spot or Flood<br>150 Watt R-40 Spot or Flood<br>300 Watt R-40 Spot or Flood                   | Provide more light on<br>critical seeing tasks                   |

light. Of all fluorescent colors, this one best reveals the product as it really is. It is an excellent lamp for merchandising, making both people and products look their best.

**Standard Warm White**—The color of the light from this lamp makes a store seem warmer and friendlier. It is a fine choice to blend with incandescent bulbs.

**Deluxe Warm White**—In addition to light that makes the store seem warmer, this lamp also features a richer color quality that

flatters complexions and shows all product colors to advantage. Just as Deluxe Cool White gives luxurious lighting in a cool atmosphere, Deluxe Warm gives new rich tone for better merchandising in a warm atmosphere. Good in reception rooms and lobbies, too.

**White**—This is a fine choice for offices and similar areas where high levels of illumination are needed, but no special effect (such as a cool or warm look) is required. It is also used in factories.

**Soft White**—The peach-white color

of this lamp is very good for making meat in showcases attractive. Also fine in bakery shops.

**Daylight** — This color looks like natural daylight. It makes rooms seem very cool, and often gives a store or a department an eye-catching blue-white radiance. It is often used to enhance white goods. Many industrials in the South use this lamp to provide a psychologically cool atmosphere.

Because of their long life, efficiency, and good lumen maintenance characteristics, fluorescent lamps

# FOR FLUORESCENT LAMPS

| AREA                                                 | APPLICATION                   | SUGGESTED LAMPS                                                                                            | EFFECT                                                                                                    |
|------------------------------------------------------|-------------------------------|------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| <b>INDUSTRIAL</b><br>(Dirty, Dusty,<br>Smokey Areas) | General Lighting              | 500 Watt R-57 Incandescent<br>750 Watt R-57 Incandescent<br>400 Watt L-HI Mercury<br>400 Watt K-HI Mercury | Reflector lamps maintain lighting levels at minimum cleaning                                              |
|                                                      | Prescription Department       | Standard Cool White Fluorescent                                                                            | Cool, clean, scientific appearance                                                                        |
| <b>DRUG STORES</b><br><br><b>VARIETY STORES</b>      | Variety Counters              | Standard Cool White Fluorescent                                                                            | Maximum visibility for displays                                                                           |
|                                                      | General Lighting              | Deluxe Cool White* Fluorescent                                                                             | Best rendering of product colors                                                                          |
|                                                      |                               | 75-Watt R-30 Spot or Flood<br>150-Watt R-40 Spot or Flood<br>300-Watt R-40 Spot or Flood                   | Highlighting feature items                                                                                |
|                                                      |                               | Standard or Deluxe Cool White* Fluorescent                                                                 | High visibility and cool atmosphere—summer                                                                |
|                                                      | Fountain or Luncheonette Area | Standard or Deluxe Warm White* Fluorescent                                                                 | Warm, welcoming appearance—winter                                                                         |
| <b>JEWELRY SHOPS</b>                                 | General Lighting              | Standard Cool White Fluorescent plus Incandescent Spots                                                    | Luxurious atmosphere for store and displays                                                               |
|                                                      | Feature Displays and Windows  | 75-Watt R-30 Spot or Flood<br>150-Watt R-40 Spot or Flood<br>300-Watt R-40 Spot or Flood                   | Extra sparkle for stones, gold and silver jewelry                                                         |
|                                                      | Dining Tables                 | 75-Watt R-30 Spot<br>150-Watt R-40 Spot                                                                    | Good lighting at individual tables when general lighting is dimmed for decorative effect or entertainment |
| <b>RESTAURANTS AND TAVERNS</b>                       | General Lighting              | Standard or Deluxe Cool* White Fluorescent                                                                 | Cool atmosphere for summer                                                                                |
|                                                      |                               | Standard or Deluxe Warm* White Fluorescent                                                                 | Warm atmosphere for winter                                                                                |
|                                                      | Kitchens                      | Standard Cool White Fluorescent                                                                            | Cool atmosphere, maximum visibility                                                                       |
|                                                      | Wall-Booth and Back-Bar       | Colored Lumiline or Fluorescent Lamps                                                                      | Decorative colors for atmosphere                                                                          |
| <b>OFFICES AND SCHOOL ROOMS</b>                      | General Lighting              | Cool White or Cool White Deluxe* Fluorescent Lamps                                                         | Cool, business atmosphere, Maximum visibility                                                             |

\* Where Deluxe lamps are used, add ¼ more fixtures to obtain footcandles required.

can economically provide high levels of general illumination over commercial and industrial areas. However, in specific places like stores and factories, there are local areas, such as feature displays, or critical industrial seeing tasks, where a much higher lighting level must be provided. This is usually accomplished with a local installation of down lights, using reflector-type incandescent lamps. It becomes necessary, therefore, to indicate where incandescent or mercury reflector lamps are desirable as a supplement, which has been done in "Ta-

ble II—Applications for Fluorescent Lamps."

## Color Rendition

Since the spectral energy distribution of each of the seven white fluorescent lamps varies one from another, colors will appear differently under each lamp. These differences are indicated in Table I. This effect of color rendition is more pronounced under some whites, and less with others. In some applications, particularly in food stores, general fluorescent

lighting is supplemented with incandescent lighting as a color correcting medium.

Many department stores check first for best color rendition on samples of merchandise to be lighted. A row of eight color boxes is arranged with a different fluorescent white lamp in each box. The eighth box contains an incandescent lamp for basic comparison purposes. Merchandise samples are duplicated in each box and a visual evaluation of the best color rendition is made from the trial. From this test, the desired fluorescent lamp is selected.



# It Pays to Package Heating and Insulation

When Shearer Electric, Arlington, Ohio, began to offer a complete home heating service—insulation, equipment and wiring—business and profits grew, customer satisfaction increased and electric heating began to roll.

**E**LECTRIC home heating is on the march in Arlington, Ohio, a modest (pop. 825) rural town in the western part of the state. Among those at the head of the line is Kenneth Shearer, an energetic electrical contractor whose enthusiasm and job record have earned him a prominent position in the ranks of electric heating promoters.

Kenny always has exhibited a personal as well as professional interest in the electrical problems of his customers. Over the years, this has earned him the respect and confidence of inhabitants within the 25-mile radius of his base of operations. So it is only logical that these people respect his enthusiastic views on the subject of electric home heating.

Four years ago, he became actively interested in electric heating and its potential market. He learned to figure heat loss, estimate heating and insulation requirements. Market development was slow at first. Then a 1.5 cent per kwhr low-step power rate by the utilities (Ohio Power Co. and Hancock-Wood Electric Cooperative, Inc.) gave it a shot in the arm. More recently a power-supplier bonus arrangement for contractors selling and installing complete electric home heating systems gave added impetus.

One factor always bothered Shearer: insulation control. For electric heating to operate efficiently, the home must have adequate insulation installed specifically for electric heat. Unless this is done, electricity as a heating medium can get a substantial

"black eye," and its market will shrink. Kenny's contention always has been that the electrical contractor must have reasonable control of this situation to assure operating efficiency and customer satisfaction. This is not always possible when others install the insulation—particularly in the scattered rural areas and especially in conversion jobs in existing homes.

Why not have the electrical contractor install the insulation too? Then he could state, without any hesitation, that electric heating will do the job he predicts. There would be no more "ifs" contingent upon condition of home insulation. Because he installed it, he would *know* that ceiling, walls and floors have insulation meeting electric heating design requirements.

Shearer was so confident of this approach that he tried it himself. And with welcomed success. Now

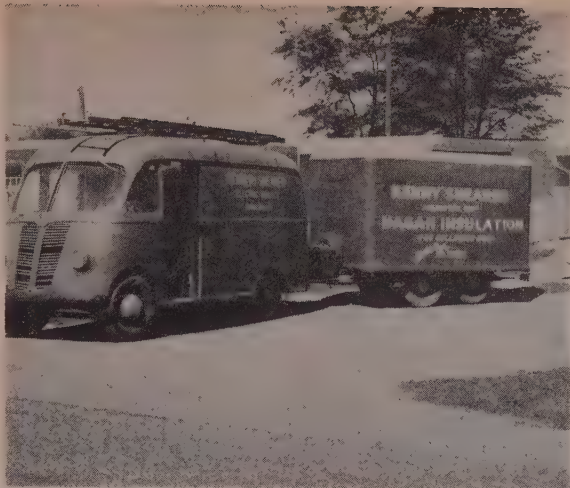
he estimates, sells and installs an "electric heating package"—insulation, resistance heating equipment and necessary wiring. To service his heating customers, he stocks a line of home insulation; has an enclosed "insulation" trailer to hitch to his service van. He can load van and trailer with equipment, wiring accessories and insulation to do a 1200-sq ft home heating job on a one-delivery basis. And he has full control of how much of what goes into the job. The customer gets a complete, efficient heating installation from one contractor on one contract.

Kenny's new service has another "plus" value. He is frequently asked to "beef-up" inadequate insulation in existing homes with fossil-fuel heating systems. When he does that, he makes certain that the resultant insulation meets electric heating requirements and so advises the customer as he enumerates the efficiency, convenience and advantages of electric heating. Next time the heating plant develops trouble, that home-owner is a prime prospect for conversion to electric heat. And once electric heat is installed, chances are the home will go all-electric—air conditioning, water heating, clothes dryer, cooking and the host of other electrical living appliances.

Does this "package" approach (insulation and heating) pay off? Shearer is firmly convinced that it does. He has the job record, satisfied customers and business increase to prove it. In 1958, he electrically heated ten new homes



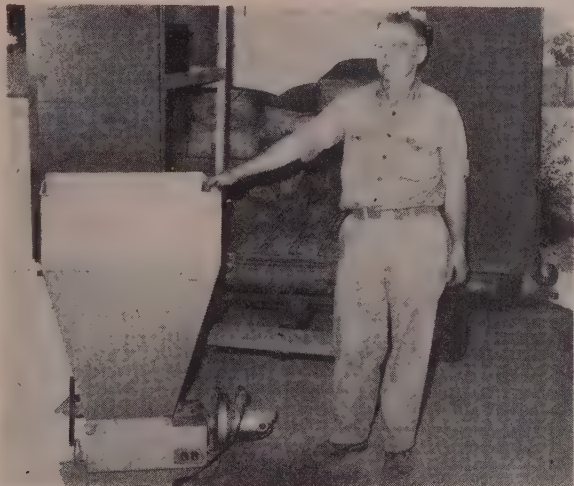
**SIGNS LIKE** these proudly announce that another home in the Arlington area is getting electric heating installed by Shearer Electric.



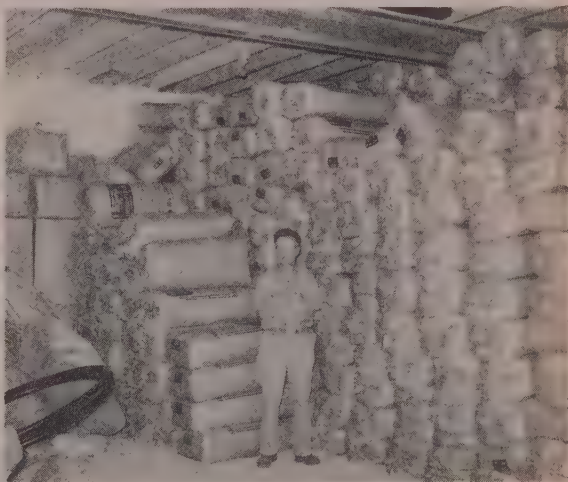
**READY TO ROLL** are Shearer's service van and trailer packed with wiring accessories, electric heating equipment and home insulation to do a complete package home heating job.



**TRAILER INTERIOR** holds insulation bags and bats, and equipment to blow insulation into walls of houses. Trailer takes about 65 bags. Another 30 to 35 bags go into van.



**CONTRACTOR SHEARER** shows assembled insulation blower. Bags are emptied into hopper attached to agitator. Blower at base forces insulation through hose into wall recesses.



**AMPLE INVENTORY** of home insulation is stocked at all times. Here's part of some 600 bags in building extension Shearer added to offer "packaged" home heating service.

and had almost as many conversion jobs. His 1959 score for the first nine months shows a healthy 50% increase, 15 jobs in each category plus a church addition going to electric heat.

But that's not all. This new approach means bigger unit contracts. Going rate for wiring (without fixtures) an average home in the area is about \$500. Add insulation and electric heating and the contract jumps to about \$1,400—almost triple the conventional job. Connected electric heating loads range from 11 to 12 kw; services are from 150-to 200-amp size; distribution panels range up to 30-circuit, including spares. Everything is "looking up" including

prospects for more business. And word-of-mouth approval from satisfied Shearer customers is proving a potent convincer.

What type of equipment is being used? Shearer's experience shows new construction jobs run almost 100% heating cable. Conversion jobs are about 50-50 wall units and baseboard systems. For home insulation, both the blow-in type cellulose fiber and vapor-barrier bats are being used. Estimated cost of doing a good (6-4-2) electric heating insulation job runs only about \$30 to \$40 more per home than conventional insulation jobs, according to Shearer. He reports very little, if any, difficulty in selling the better job.

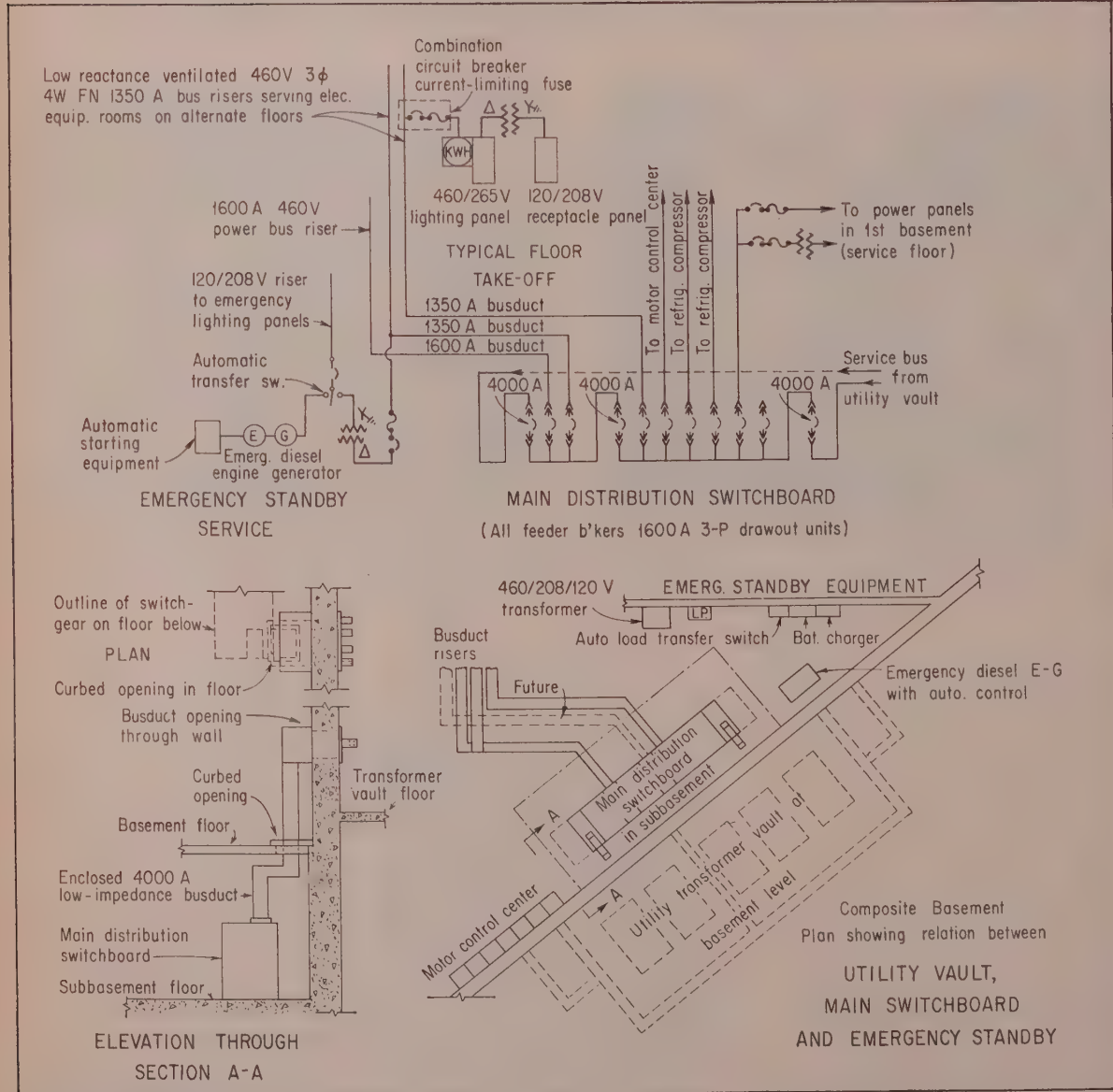
Several factors are contributing to Kenny's present success in the heating field: his interest in and contagious enthusiasm for electric heating; his avowed personal and professional interest in his customers' electrical problems and the unqualified confidence they have in him; the one-contract, one-firm appeal of his "package" deal; the significant promotional value of his "insulation trailer" as it follows his service van enroute to an electric heating job; his stature in the community as a man who knows whereof he speaks. With tools like these, he is doing an outstanding electrical contractor job for electric heating. So far, he's getting over 50% of the jobs he figures.



# Modular Service

... for new San Francisco skyscraper. Graphic supervisory board plus use of high-cycle dual-coded relays insures positive centralized control of all remote motor applications. Electrical contract was joint-ventured by Charles A. Langlais and Ets-Hokin & Galvan.

By Hugh P. Scott



**BASIC DISTRIBUTION** combines use of double-ended main switchboard, twin busduct risers for lighting and a third unit for power, a diesel generator and automatic transfer switch

for emergency standby service, plus installation of combination circuit breaker and current-limiting fuse for each typical floor's local service.

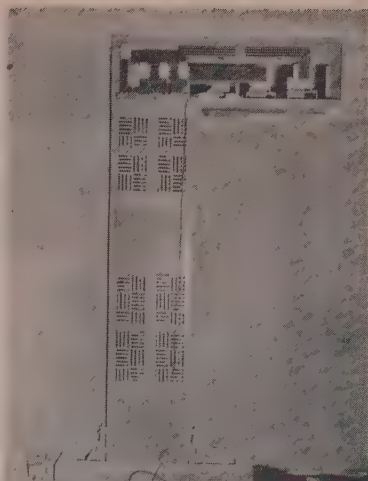
**M**OST-RECENT structure in downtown San Francisco's commercial renaissance is a new 20-story skyscraper just completed for the Crown-Zellerbach Corporation. The building offers complete air conditioning, lighting combining numerous practical design and control features, dual 4000-amp service entrances, automatic transfer provisions for emergency lighting, a bank of ten high-speed elevators, a basic low-reactance busduct system for vertical distribution of power, plus a flexible cellular-floor lateral distribution system that provides all 5½- by 5½-ft modules in the building with power, receptacle, communication and telephone provisions.

Sixteen of the floors are typical in layout and service facilities, such floors being alternately served by two 1350-amp 460/265-volt ventilated busducts that pass upwards through tiered electrical-equipment rooms on the various levels. In each equipment center, a main power panel is connected to its corresponding riser through a combination circuit breaker and current-limiting fuse and, although tenants are not sub-metered, a heavy-duty meter socket is provided alongside each 460/265-volt panel for the purpose of load-checks and balancing.

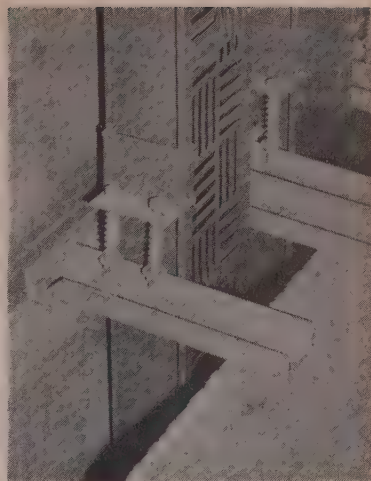
To step voltage to 120/208 for receptacle use, equipment rooms likewise contain delta-wye 3-phase dry-type transformers designed for low-decibel operation. And, to further minimize hum transmission and vibration, transformers are vibration-damped and doubly supported by (1) rod hangers secured to continuous-slot lipped-channel concrete inserts in slabs above, and (2) additional sway-bracing members tack-welded directly to structural building columns.

As indicated in the accompanying plan of electric room, these centralized equipment areas also contain emergency 120/208-volt lighting panels, splice and pull-boxes and risers; also low-voltage TV and communications terminal facilities which are secured, independent of plywood backing boards by concrete-wall anchor-bolts. TV system was designed for 13-channel, color and UHF reception.

All equipment except normal-service lighting and receptacle



**PRIMARY POWER BUSDUCTS** enter building proper from utility vault constructed outside but adjacent to common structural wall. Then, since building's main distribution board is located at sub-basement level, busducts are dropped through curbed openings in basement slab to top-connect with main breaker cubicles. This view shows offsetting and interleaving of bus bars.



**BUSDUCT RISERS** through building are supported at each floor by spring-mounted shoulder angles that cradle duct casings against possibility of earthquake-related vibrations. Slab slots are sufficiently sized to accept three busduct risers already installed, with excess passage for banks of vertical conduits and fourth duct if found necessary at later date.



**MAIN SWITCHBOARD** is one floor below, but back-to-back against common wall of utility transformer vault, thereby permitting direct connections of twin primary busduct runs with opposite ends of this sectionalized free-standing assembly. Main and tie breakers are electrically operated 4000-amp draw-out units. Feeders serve power and lighting bus risers, motor control centers, compressors and power panels on service floors.

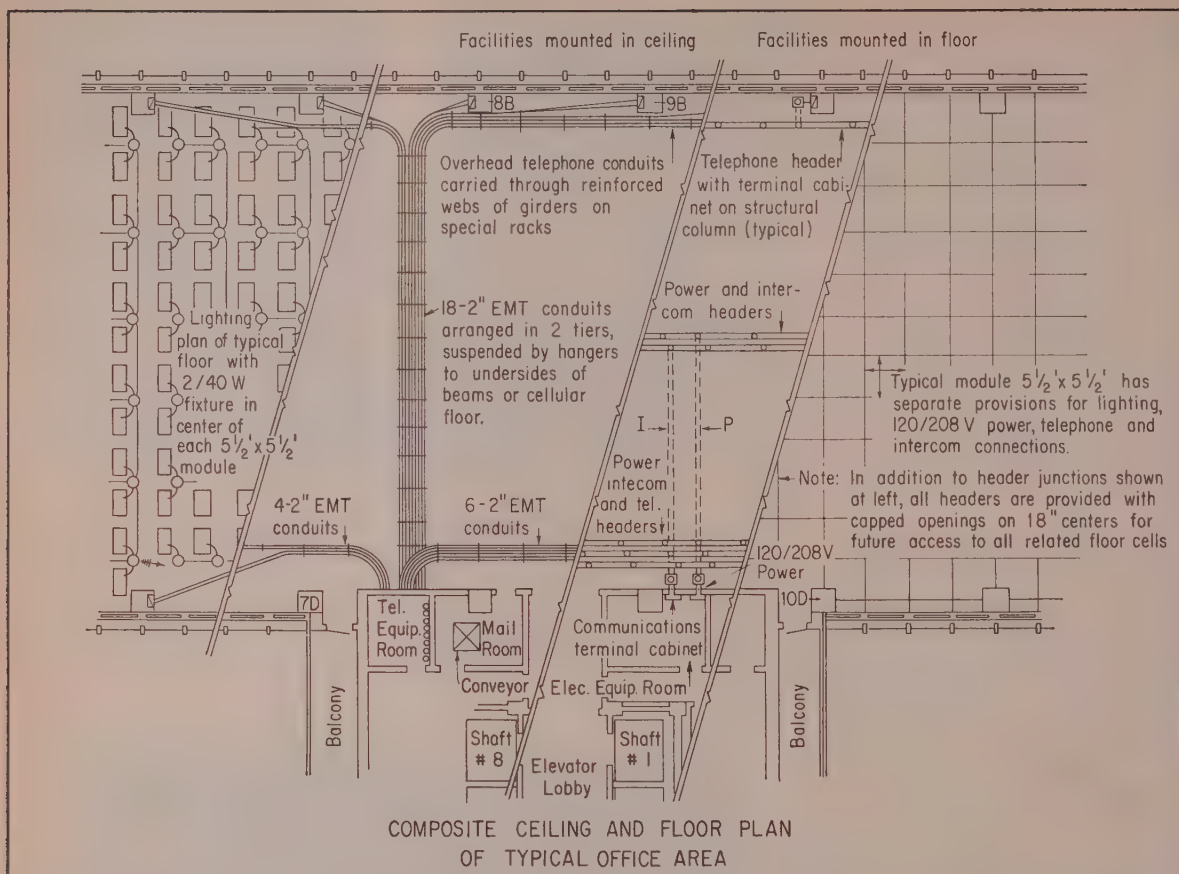
panels is segregated behind wire-mesh partitions and normally locked sliding grilles.

In carrying busducts up through the tiered electrical-equipment rooms, duct casings were supported at each floor level by shock-absorbing brackets. Designed to minimize vibrations which might possibly accompany earth tremors, these brackets consist of shoulder angles bolted to sides of bus enclosures, channel sections that straddle slab

slots, and vertical bolts welded to the channels. Bolts slide freely through holes drilled in the angles while coil springs surrounding the bolts serve to cushion the duct-supporting shoulders. This mounting method effectively suspends the ducts on a series of "floating" bridges.

Slab slots, incidentally, are sized to permit passage of the three now-installed low-reactance busducts (a 1600-amp power assembly as





**TYPICAL FLOOR** provides duplicate facilities for lighting, air conditioning, power, intercom and telephone service for each 5½-by-5½-ft module, thereby permitting extreme flexi-

bility for office layout and placement of desks or partitions. Circuitry is carried overhead via conduit and underneath via cellular flooring.

well as the two 1350-amp risers for lighting), plus a possible fourth duct to be installed if future load requirements dictate, plus additional space to accept several banks of vertical conduit risers.

### Cellular Flooring

In each electrical equipment room, panels related to communications and to 120/208-volt receptacle service are connected to main-floor cellular structures via appropriate box connectors, duct couplings, header members and oversized junction boxes.

Use of cellular flooring provides all areas with a complete system of raceways for telephone as well as other communications and 120-volt service, inasmuch as duplex receptacles and fittings (satin aluminum with U-slot grounding provisions) can connect with any of these three services in each modular floor section.

### Unique Lighting Details

While on the subject of typical-floor facilities, it should be noted that (like floor-contained power, communications and telephone services) lighting is likewise designed on a 5½-by-5½-ft modular spacing pattern.

Fixtures themselves are 2-by-4-ft 265-volt 2-lamp troffer units with rapid-start tubes, high PF ballasts and white plastic bottom panels. Several special features, however, merit more detailed comment.

For example, luminaires were made an integral part of the air conditioning system, with an entrance diffuser at one end of the lamp housing and an exhaust vent at the other. This provision for induced ventilation materially lowers ambient temperatures of components, improves operating characteristics and overall lumen output.

Moreover, since luminaires were equipped with threaded corner

studs which were then secured to channel hangers, installation was mainly an assignment of positioning, adjustment and attachment by wing nuts.

Flexible metal connections between fixtures and JB's were prewired with pairs of No. 16 AF conductors. EMTs supplying each pair of luminaires are ½ in. ID, while sections used as HRs were sized at ¾ in.

Where local control of lighting was desired in addition to centralized 265-volt switching, 24-volt single-phase transformers and low-voltage relays were mounted as integral parts of JB assemblies, and low-voltage wall switches were installed on plaster-framed columns in the immediate vicinity.

### Back-to-Back Service Facilities

As indicated in the composite basement plan, the primary utility vault and main distribution switch-

board are located back to back, although they vary considerably in elevation and are on opposite sides of an exterior structural wall. Therefore power is carried between these two centers via twin interleaved 4-wire, 4000-amp low-impedance metal-enclosed bus structures that first pierce the structural wall horizontally, then drop through curbed openings in the basement floor to top-connect with main breaker cubicles of the double-ended switchboard.

Utility network voltage is at 12,000 stepped to 460/265 in PG&E's undersidewalk 4000-kva vault before being carried into the building proper.

Construction of the main distribution board is dead-front, free standing, with electrically operated draw-out 3-pole 4000-amp air breakers used on mains and also as a normally open tie between the board's two bus segments.

Through 1600-amp secondary draw-out breakers with current-limiting fuses, one section of the board serves two busduct risers (a 1600-amp unit for power and a 1350-amp duct for alternate-floor lighting and receptacle use). The other section of the board serves a second similar 1350-amp busduct riser, plus cable-in-conduit feeders for control centers, two 400-hp refrigeration compressors, also power panels on the service (1st basement) level related to supply and exhaust fans.

Grounding of the main switchboard is via a continuous 1½-by-½-in. copper bus which is bonded to frames of all electrical enclosures and related equipment, and which is also bonded to the building's water system (through series of bare stranded copper 500MCM cables in conduit) on the street side of the main meter and on the ground side of all dielectric unions. For grounding the four 1000-kva transformers in the adjacent utility vault, a separate bus and ground-rod installation is provided.

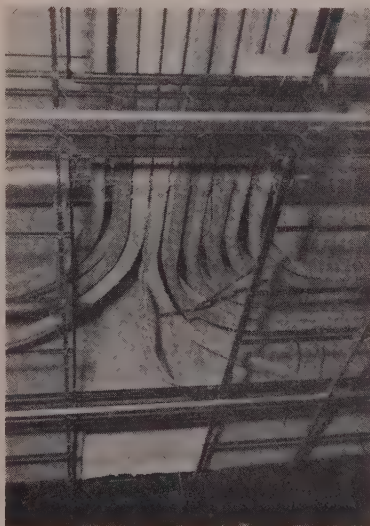
Essentially, all power take-offs from busduct risers are through combination circuit breakers and current limiting fuses, while cable tap boxes and auxiliary risers are installed in several locations to carry power to local motor-control centers and penthouse power panels.

Throughout the building, motor load is extensive, for, besides the

two 400-hp refrigeration compressors, the structure is served by ten elevators, ten supply fans rated to 100-hp each, a pair of air compressors, three cooling-tower fans (single- and 2-speed), eight exhaust fans rated up to 25-hp, and 32 vari-purpose pumps with capacities going to 40-hp each.



**SECONDARY TRANSFORMER** installed on typical floor (lower unit) was amply sized to take care of "normal" 120/208-volt receptacle load plus "liberal" surplus. However, indicative of enthusiastic all-out adoption of electrified office equipment by some of the tenants, second (upper) transformer had to be installed to supply the added demand. Where this was done, both transformers were mounted to same vibration-damped hangers anchored to continuous-slot inserts in overhead concrete slab.



**TIERED TELEPHONE CONDUITS** are carried across typical floor, suspended by trapeze hangers and rod hangers secured to underside of cellular flooring, or attached directly to lower flanges of floor beams. When they reach exterior building line and fan sideways to serve terminal boxes mounted on building columns, conduits are carried through girder webs.

## Automatic Emergency System

Should utility service be completely interrupted or if utilization voltage should drop below 70% of normal, emergency power (for essential lighting in corridors, stairwells and equipment rooms) would be provided by a standby 4-stroke water-cooled vertical inline 60-hp diesel engine and a 30-kw 120-volt revolving-field generator with direct connected exciter. Generator output is kept within 3% of rated voltage through operation of a gear-driven hydraulic governor mounted on the engine, while engine safety is insured by an over-speed-stop plus alarms that report low oil pressure and excessive water-jacket temperature.

On normal and emergency systems alike, cable feeders and subfeeders are RH-RW, with TW wire used for branch circuiting and AF wire for connection of lighting fixtures. All general lighting, incidentally, is at 265 volts, except for emergency illumination and on the service floor where (due to code limitations related to ceiling heights of less than 8 ft) lighting is at 120 volts.

All feeders and subfeeders are tagged with metal or fiber identification markers in all junction- and pull-boxes, and all branch wiring is coded by color. Local control panels (460/265 as well as 208/120 volts) are conventional assemblies with thermal-magnetic quick make-break breakers, copper busbars, solid neutrals and bolted-type solderless main connections having lock washers on lug bolts.

## Central Motor Control

In various motor-control centers, air circuit breakers are combined with magnetic starters and starters are connected to bus structures by means of self-aligning stab-on connectors with free-floating spring construction to insure positive silver-to-silver contact with both sides of the bus. External operating handles are interlocked with breakers so that doors of cubicles cannot be opened until handles are in the OFF position, and all such units of like capacities are easily removable and interchangeable.

In general, starters have standard start-stop PB stations for manual control, jog-type start buttons



for motors with automatic control, and, when remote control is also provided for, starters are related to separate relays, transformers and switches.

Separate motors are generally separately circuited, conductors being carried in rigid conduit to suitable fittings on motor mounts, then through flex to final connection terminals to provide for adjustment and vibration possibilities.

In connection with the subject of remote control (for various fans, pumps, lighting banks, valves, dampers, etc.), high-cycle carrier

current is super-imposed on the basic 60-cycle distribution system in order to activate related remote switches and dual-coded relays.

High-cycle signal-generating equipment includes power transformers, tube-type impulse transmitters, signal amplifiers, capacitor coupling units, plus a master control panel located remotely in the engineer's office.

Having the ability to control up to 38 separate circuits electronically, this central operation panel includes master clock and programming mechanisms, deactivating

switches for each circuit, a signal-transmission verifier to monitor all command impulses and verify their correct coding, circuit-status indicating lights, plus PB controls to permit manual signal transmission to various non-coded receivers.

Programming mechanisms are removable-drum minute-interval selection devices, and circuit-status lights indicate when command signals are being, or have been, superimposed on the distribution system.

At signal-receiving points (connected directly to motor starters), dual-coded relays combine electronic receivers with electro-mechanical decoding mechanisms capable of detecting and acting upon their specific, individual coded signal. When so activated, relays close to provide necessary contact of 60-cycle circuitry.

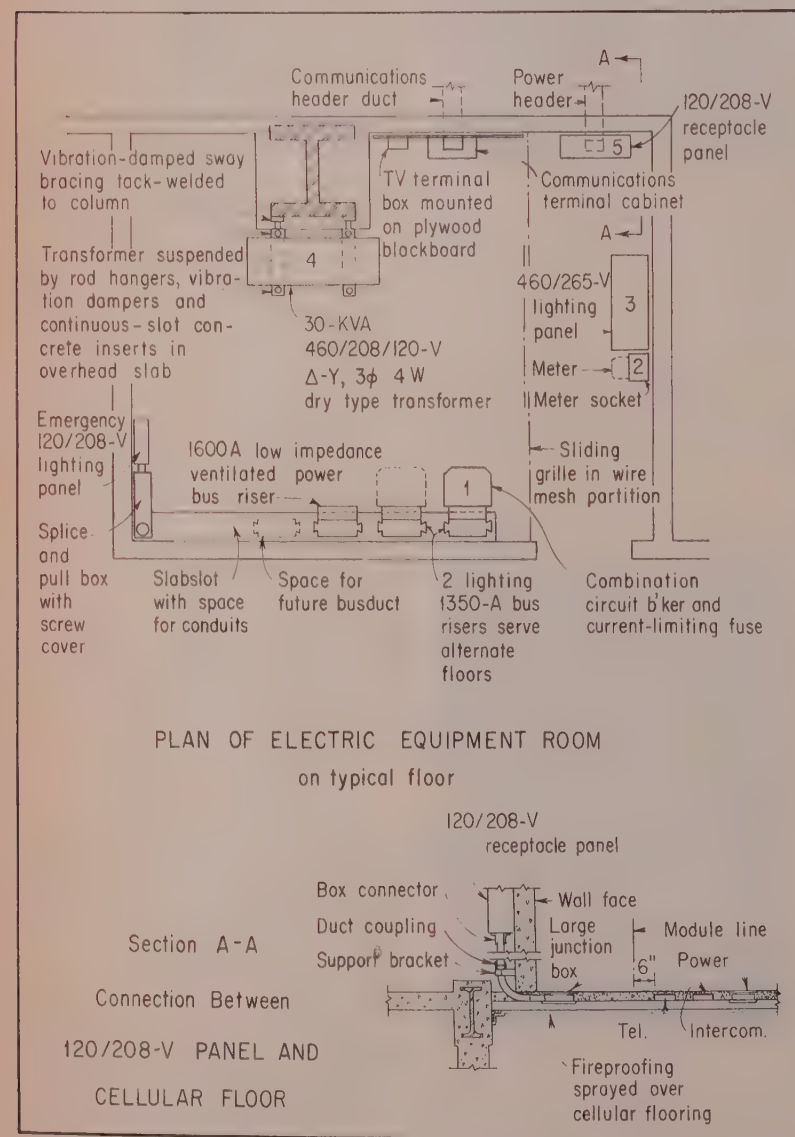
To preclude large blocks of power being connected simultaneously to the building's distribution system, this installation provides that (should a utility power interruption occur to cause motors to drop out of service), those motors controlled by carrier-current would remain off until switched on again progressively.

### Graphic Control Center

To provide remote-control operation of motors and also to permit central monitoring and supervision of all pumps, fans and dampers in the building, the superintendent's office in the basement is also equipped with a large graphic control and sensing panel.

On this 9- by 14-board, the status of various fan, pump and ejector systems can be noted at a glance by observing series of pilot lights placed schematically on lucite-engraved color-filled back-lighted graphic representation diagrams. Various strip-chart recorders, indicating and totalizing meters, pneumatic thermometers and damper-position indicators are also provided to inform the watch engineer when and where fire conditions prevail, when sump pits are high or storage tanks are low, what the temperature is in any zone of any floor, or what the wet and dry-bulb temperatures are in any supply or exhaust duct.

In addition, annunciator alarms warn when filters are clogged, have broken rolls or have exhausted media, while control and oiltight



**COMPACT ARRANGEMENT** of tiered electric equipment rooms show basic routing of power through combination breaker and fuse (1) to meter socket (2) 460/265-volt panel (3) secondary transformer (4) and receptacle panel (5). Connection of 120/208-volt panel to cellular flooring is by means of box connector, duct coupling, large-radius ell and oversized junction box.

selector switches, alarm reset and temperature buttons for fan discharge provide additional means for centrally checking and operating these enumerated services. Circuit wiring carried up through the building (for control of air filters, house tanks, motor control centers and shielded-cable dew-bulb systems) is supported every six floors by use of special pullbox assemblies.

In the building's main lobby, interest focuses upon a unique lighting treatment consisting of a suspended sheet-brass ceiling containing hundreds of circular clear-plastic discs back-lighted by closely-spaced fluorescent lamps mounted in continuous rows.

In this installation, 4- by 4-in. wireways are used to carry all necessary wiring, ballasts and lamp holders. End caps are used to close wireways at ends of runs, and conduit spacers are used between runs where direct connection is impractical.

Credit for the electrical design in this modern skyscraper belongs to Hertzka & Knowles and to Skidmore, Owings & Merrill, associated engineers and architects, with special recognition going to Engineers Alex Boome, Walter Geoltz, Frayne Fennie and Dan Parenti.

Installation of the electrical work was by joint-venture contractors Charles A. Langlais and Ets-Hokin & Galvan, with Chick Terrill of the Langlais organization supervising and Leonard Andrews acting as job foreman.



**INSTALLATION** of lighting fixtures was simplified through the provision of threaded corner studs secured to channel hangers, permitting fast attachment by wing nuts plus subsequent leveling. Installation was also speeded by pre-wiring and assembly of flexible metal connecting sections, junction boxes and thinwall branch conduits.



**INTEGRATING** air conditioning with lighting, each recessed luminaire combines an entrance diffuser at one end and an exhaust vent at the other, thereby creating induced ventilation that lowers ambient temperature of ballasts and improves overall operating characteristics of system. Fixtures are 2-lamp 265-volt, 2- by 4-ft units set on 5½- by 5½-ft spacing pattern.



**MOTOR STARTERS** controlled remotely by high-cycle carrier current, equipped with separate dual-coded relays, transformers and switches, are related to fans, pumps, dampers, valves and lighting in various public areas. High-cycle signal-generating equipment includes tube-type impulse transmitters, signal amplifiers, capacitor coupling units and a master control panel located remotely in the engineer's office.



**GRAPHIC CONTROL** and sensing panel, consisting of pilot lights, lucite-engraved color-filled back-lighted graphic representation diagrams, strip-chart recorders, indicating and totalizing meters, pneumatic thermometers and damper-position indicators, permit the watch engineer to monitor and operate major items of equipment from his remote-control station.





**TRUNCATED DIAMOND** pattern of directors' table and luminous lensed troffer defining table's border is miniature duplication of building's general plot-plan, while auxiliary recessed downlights are installed to highlight notes of individuals in conference. Separate circuiting and dimming provisions permit creation of desired lighting environment.

*\$20-million Los Angeles office building is . . .*

## Designed for 100%

Electrical system has 18 substations and 5 motor control centers, over 115 miles of cellular-floor wiring related to 4 services, a connected load of 9,000-kw and over 19,000 lamps employed in a wide variety of lighting treatments. Engineered by Charles Luckman Associates, William L. Pereira, associate architect, and installed as a joint venture by C. D. Draucker and Newbery Electric.



**UNION OIL CENTER**, consists of four structures, largest of which is a diamond-shaped 13-floor office building, electrically served through a dozen substations and flexible cellular floor distribution system.

**U**NION Oil Center in downtown Los Angeles combines four buildings with a 1400-car underground garage. The main 13-story truncated-diamond-shaped office unit uses a dual-core utility concept wherein twin cores rise vertically through the structure at either end to (1) stabilize the building against seismic forces, (2) conveniently concentrate all electrical shafts and closets, mechanical ducts, air conditioning and plumbing facilities, and (3) thereby leave maximum unobstructed areas in center floor sections to permit greater flexibility in the utilization of office space.

In anticipation of considerable future expansion, service entrance, primary vault and main switchgear arrangements at present provide



**OFFICE AREAS** are illuminated to levels ranging between 40 to 55 footcandles, depending upon variations in row-to-row mounting distances of lightstrips and different milliampere ratings of ballasts. Distribution characteristics are also altered by supplemental installation of plastic diffusing panels.



**MAIN LOBBY** is lighted by large central luminous ceiling installation, several types of recessed spot and floodlight lensed and louvered units, also unique luminous column effect created by special fixtures concealed at floor level and ceiling elevation.

## Electrical Expansion

considerable excess space and spare capacity. For example, although the primary vault presently contains two 5000-kva banks of 34.5-kv/4160-volt transformers plus related equipment, the room is liberally proportioned at 40 by 55 ft to accommodate considerably more equipment. In addition, extra now-empty 5-in. underslab fiberducts, connecting the vault with a street-side utility network manhole, are available to accommodate additional primary feeders when needed. Considerable space for expansion is likewise provided in the separate 4160-volt switchgear room, where spare secondary-breaker cubicles already are incorporated in the two existing boards, while bus arrangements and flanking floor space would permit still further expansion of present boards, plus the installation of a third complete switchgear assembly if needed.

The primary transformer vault is cooled and ventilated by a thermostatically-controlled blower system. Extensive grounding of equipment housings is provided by a bare stranded copper 4/0 cable imbedded in the slab and braised to 15 driven rods as well as to the building's cold water system. A dry environment is insured by a large central

grating-covered sump and pump. Incoming primary feeders are through fiber conduits supported by steel channels, in turn encased in concrete for maximum rigidity and protection. Primary breakers are interlocked so that only one feeder is in operation at any instant. Feeders are cross-connected on the primary side of main transformers by a normally-closed segmented bus and on the secondary side by a N. O. tie. Secondary power connections to adjacent switchgear are via twin overhead 1200-amp, 4-pole, 4160-volt, low-reactance ventilated feeder busbar assemblies that traverse the intervening bearing wall through appropriate sleeves.

Both 4160-volt switchboards, one allocated solely for power, the other for lighting service, consist of free-standing metalclad 5-kv components; all breakers, both main and feeder, being electrically-operated draw-out 1200-amp air CBs, although all feeder breakers are presently fused for 225 amps. DC for breaker control purposes is provided by a 92-cell nickel-cadmium 125-volt wet battery having a 1-minute rating of 240 amps.

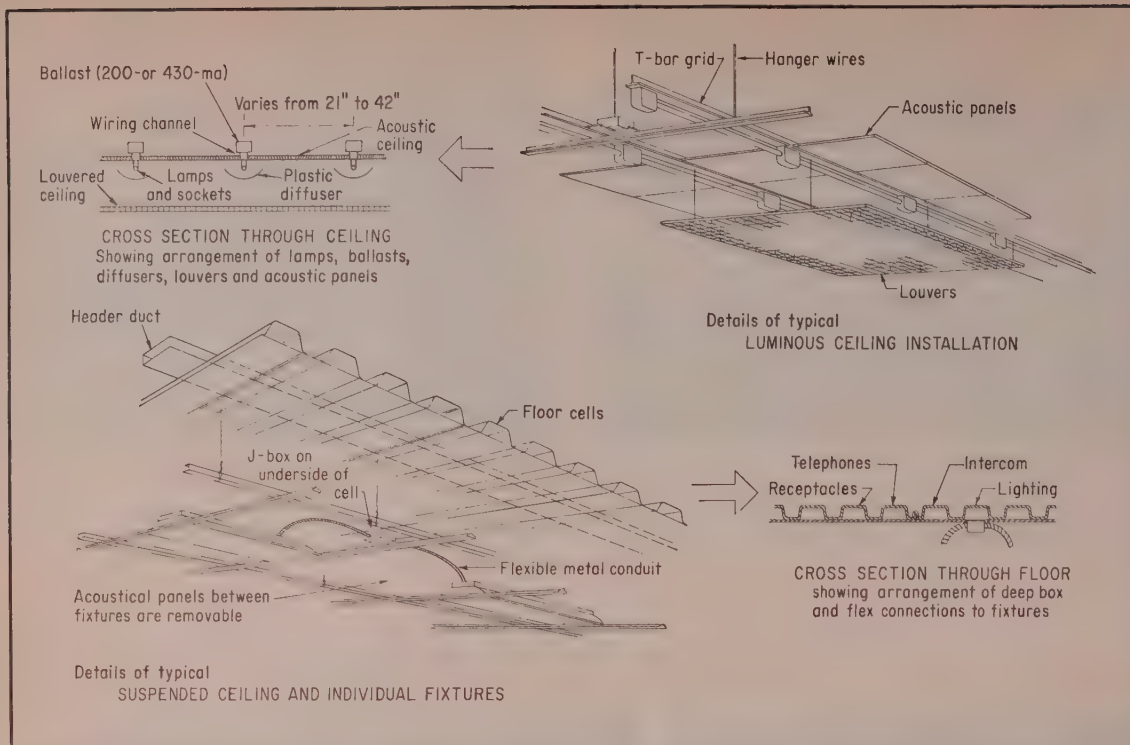
Of four feeders now radiating from the power board, one serves

a 1500-kva, air-cooled, delta-delta transformer that steps current to 480 volts to feed a 2000-amp low-reactance busduct installation which, in turn (and through appropriately-sized plug-in CB cubicles), serves five motor control centers located in various sections of the main diamond-shaped building.

All of these MCCs have common bus structures, ACBs and motor starters with overload protection; some of the motors so controlled also having disconnects located closely adjacent to them. Motors controlled by these five centers, totaling 900-hp in rated capacities, are related to house and sewage pumps, fuel and boiler feeds, burners and a variety of supply and exhaust fans.

Served by the three remaining power feeders are (a) two 4160-volt compressors with 700-hp motors operating through combination reduced-voltage starters, grids and drum controllers, and (b) three additional 4160/480-volt substations; one 500-kva unit powering two 4-wire motor control centers related to roof fans and exhausts, cooling towers and elevators in the central building; the other two substations being 750-kva units collectively serving four more 3-wire





**GENERAL LIGHTING** in office areas is provided variously by individual fixtures recessed into suspended acoustical ceiling, and by continuous lines of fluorescent lamps

mounted above louvered panels. Auxiliary use of plastic diffusers, different configuration of cells and mounting dimensions provide local variations.

MCCs related to elevators and escalators, supply and return-air fans in two of the smaller "satellite" buildings.

In these latter three unit subs, incoming sections contain 3-pole, 2-position, gang-operated, air-insulated load breaker switches with exterior handles. In addition, dry-type power fuses are located between high voltage switches and transformers, while fuse compartment doors are interlocked to prevent their opening while switches are in ON positions.

At one of the 750-kva stations, where primary feeders are tapped but do not terminate, a set of clamp-type connectors is provided in the bottom of the high-voltage cubicle for that purpose.

This same arrangement of incoming sections, load-break switches, power fuses and clamp-type connectors is duplicated at 14 lighting substations served from the second main 4160-volt switchboard, although these subs (10 of which serve the main building, with two serving each of two satellites) have 120/208-volt, 4-wire secondaries. Transformers in this group are predominantly 225-kva dry-type low-decibel units.

### Lighting Subs in Twin Cores

One lighting sub is located at either end of every third floor in the diamond-shaped main building; secondary feeders then extending to distribution panels located in the same electric closets, also to smaller closets located on floors immediately above and below these substations.

In addition to the two primary interlocked utility service entrances, continuity of emergency power is insured through the provision of two 480-volt 3-phase 3-wire 100-kw diesel engine generators wired in parallel to a 300-amp circuit breaker and bus structure. Generators, delivering rated capacities at 80% pf, are equipped with such accessories as automatic voltage regulators and starting equipment, also remote alarms and indicating lights to signal overspeed, overcranking, low water or oil, excessive temperatures and other similarly abnormal conditions. Starting is by means of separate 24-volt dc battery systems connected to each generator.

Due to the extent and complexity of power and lighting facilities, five separate automatic transfer switches (rather than one) are

functionally located; two being placed at two of the motor control centers to insure continuity of essential 480-volt sewage and house pumps, elevators and air compressors; the remaining three transfers being related to 120/208-volt emergency lighting panels.

In the case of 480-volt emergency panels, alternate power sources are provided through connections to (1) generator and (2) MCC bus structures. And, in the case of the 120/208-volt transfer switches, alternate sources are obtained through (1) lighting substation secondaries and (2) a 75-kva dry-type transformer breaker-connected to the diesel-generator bus.

Emergency loads are transferred from normal to auxiliary power facilities when any phase of the normal supply falls below 70% of nominal voltage, while re-transfer back to normal service occurs when all phases have returned to at least 90% of these same values. Switches, electrically operated, are mechanically held by either normal or emergency power; all operations taking place automatically under the various indicated conditions. Diesel generators are started automatically if normal power fails.

## Wiring via Cellular Flooring

Lateral distribution of wiring on the various floors is primarily via triple underfloor ducts, cellular floor channels, or combinations of these two basic systems. For example, distribution from power panels in typical electric closets is downward to connect with floor cells related to receptacle wiring, and upwards to connect with floor cells above related to lighting.

Connections between panel boxes and cells is by means of box connectors, duct sections, couplings, ells, end closures and cell junction units. After connecting with designated cells, wiring is carried laterally to header ducts, then changes direction again for further distribution to other similarly-related cells.

Floor cells are spaced on 6-in. centers and, in every 7-cell series, at least one cell is related to (1) receptacle power, (2) lighting, (3) telephone and (4) various Union Oil intercom systems. Remaining cells in each 3½-ft span are spares, allotted among these four service functions in accordance with specific requirements of the floor being considered.

When cells are related to lighting, wiring connections with fixtures are via deep under-cell outlet

boxes and flexible metal conduit leads.

Some idea as to the wide variety of lighting mediums evident on this project is provided by the fact that 55 different fixture types or variations are employed to obtain desired functionalism and lighting effects.

For example, typical office space is variously illuminated by recessed fluorescent oblong or square fixtures installed either singly or in continuous rows with bottom panels consisting either of metal or plastic louvers, glass or plastic diffusers or lenses. In addition, extensive use is made of wall-to-wall luminous ceilings; cells being variously square or circular, while back-lighting fluorescent lamps are installed either with or without auxiliary diffusing panels placed beneath them. Even in areas with similar lighting treatments but having different types of occupancy or utilization (such as private executive offices, secretarial bays, filing and accounting divisions), lamps vary in row-to-row distances from 21 to 42 in., ballasts are variously 200 or 430 milliamps, while lighting levels at desk tops resultingly vary between 40 and 55 footcandles; corresponding lighting loads ranging between 2.8 to 4 w/sq ft.

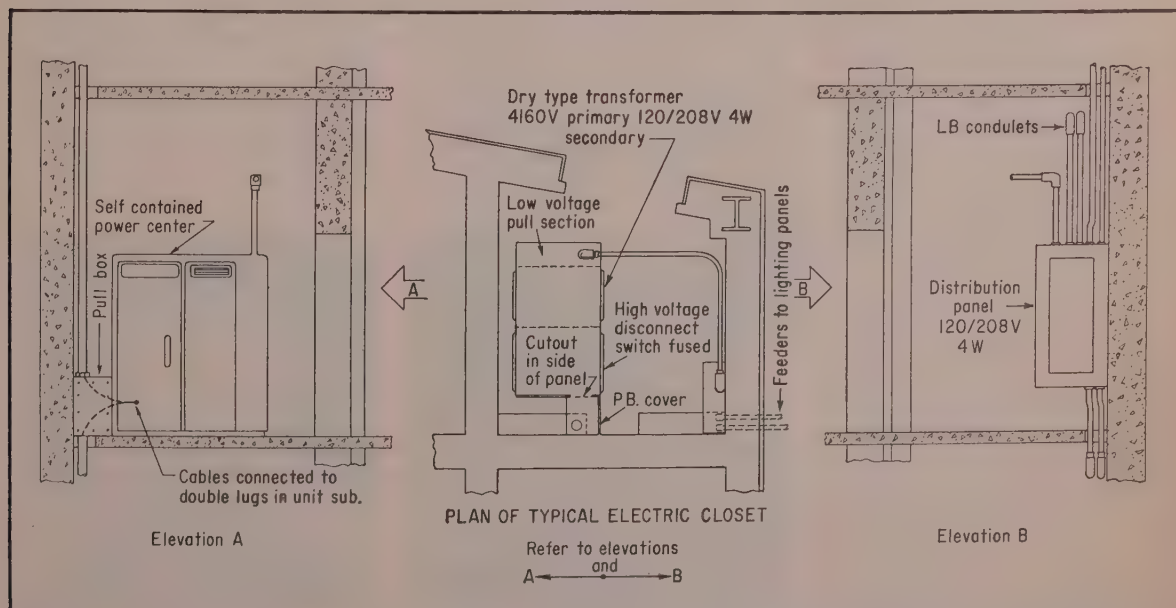
In areas lighted by recessed fixtures, adjacent acoustical ceiling

panels are removable to permit access to the overhead, while both the fixtures and the adjacent acoustical panels are mutually supported by common grids of suspended channels and inverted T-bars.

Where lamps-in-line are used above luminous ceilings, acoustical panels are installed at the same elevation as wiring channels so that ballasts are mounted above, within so-formed return-air plenum chambers, while sockets and lamps are positioned just below this suspended barrier.

With a 100% expansion program as a distinct future possibility, sufficient additional ground has been allocated (presently used as the central plaza) to permit the erection of another 13-story 165-ft-high diamond-shaped office unit which will eventually tie into the existing elevator core, while foundations and bearing walls of the smaller flanking structure were designed to support several additional upper floors if and when required to do so.

Planned, designed and engineered by Charles Luckman Associates with William L. Pereira as associate architect, this project was built by Del E. Webb Construction Company. The electrical installation was a joint venture by the firms of C. D. Draucker and Newbery Electric.



**LIGHTING SUBSTATIONS** are located every third floor; twin installations being installed in utility cores located at either end of the central structure. Secondary feeders from 4160-

120/208-volt dry-type transformers serve local branch circuit distribution panels on floors above and below as well as in substation.





**PLASTIC-COATED** steel tubing is used in the coke conveyor gallery to resist the highly corrosive atmosphere resulting from coke quenching.



**CORROSIVE EFFECT** of ammonium sulphate deposits is graphically demonstrated in the way it has eaten away a section of this metal motor housing.

**A**PPPLICATION of plastic-coated steel conduit has licked a very big corrosion problem in the mill of Republic Steel Corporation, Cleveland, Ohio. Corrosive atmospheres generated in the coke oven areas of a steel mill will destroy any type of ordinary metal electrical conduit over a period of time—requiring continual replacement. But Republic has come up with a solution. They are now using steel raceways with a plastic “overcoat” which makes the raceway impervious to the fumes and dusts in the atmosphere.

Five thousand feet of plastic-coated, electrical metallic tubing was installed in the coke oven area 18 months ago. A recent inspection showed that the plastic-covered steel raceway was in just about the same condition as when it was originally installed. On the other hand, the standard rigid galvanized conduit that it replaced had been virtually destroyed over a 5-year period. Plant engineers indicated that on the basis of how the plastic-coated tubing has held up for the past year and a half, it can be expected to hold up many more years.

# Conduit Combats Corrosion

Plastic-jacketed steel conduit has measured up to the rigors of application in the highly corrosive atmosphere of a steel mill.

One particular trouble spot was in the coke conveyor gallery of the mill where a strong concentration of ammonia still waste fumes (resulting from the coke quenching operation) had, over the years, badly corroded the standard rigid galvanized conduit, which housed lighting lines and lines for control of conveyor motors. This caused grounding and shorting circuits, resulting in temporary loss of lighting facilities and “down” time for the coke conveyor. The new plastic-coated EMT is now successfully resisting corrosive attacks.

In still another area, a different type of corrosion problem exists in the company's ammonium sulphate dryer building where the coal by-product is processed. Heavy wall galvanized conduit has been decimated in a short time as a result of the corrosive dust in the atmosphere. An idea of the corrosive character of the ammonium sulphate dust is evident in that sections of metal pumps, the steel

housing of motors and cast iron terminal boxes are completely eaten away over the years. All heavy-walled galvanized conduit is now in the process of being replaced by plastic-coated rigid steel conduit in the dryer building.

Plastic-coated electrical metallic tubing is joined by means of simple compression couplings and can be bent on the job with a standard side wall supported bending tool. This eliminates the need for heavy threading and bending equipment on the installation site. The bending requires only one man.

In preparing plastic-coated lightweight steel raceway for a coupling or connector, the plastic covering is cut down to the galvanized section of the tube, several inches from the end, so that the proper fitting can be installed. The coating is peeled off and the bare end inserted into the coupling. Finally, this is sealed by wrapping a double thickness of polyethylene or vinyl-back insulating tape around the tubing.



**GALVANIZED CONDUIT**, heavy-wall type, is seriously corroded by the atmosphere generated in the area of the coke ovens (left) and inside of the ammonium sulphate dryer building (right)



# THE Pennsylvania NEWS

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**EXTRA**

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## PENNSYLVANIA TRANSFORMER ANNOUNCES COMPLETE LINE OF SECONDARY UNIT SUBSTATIONS AND LOW VOLTAGE SWITCHGEAR

### Products Include Indoor and Outdoor Substations, Articulated and Integrated

A complete line of secondary unit substations and low voltage switchgear assemblies is now being manufactured by Pennsylvania Transformer Division, McGraw-Edison Company. Products include both indoor and outdoor articulated and integrated substations.

Announcement of the new products was made by W. R. Swoish, vice president, who reported the opening of special departments to handle manufacture and sale of the products. Manufacturing facilities and offices are adjacent to the company's main transformer plant in Canonsburg, Pa.

#### Ratings from 75 through 2000 Kva

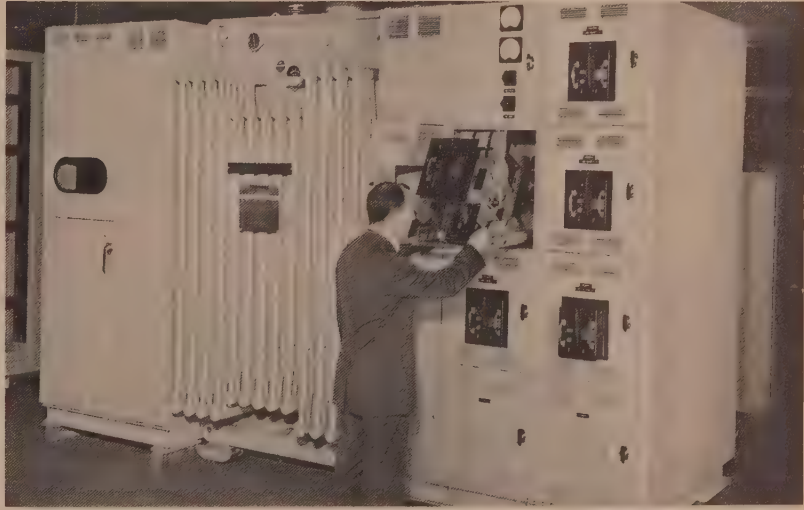
According to Mr. Swoish, Pennsylvania's new articulated substations, which consist of subassemblies for field connection, range from 112½ through 2000 kva. Integrated substations, which are completely assembled at the factory, range from 75 through 500 kva. Normal primary voltages are from 2400 through 13,800 volts, with secondary voltages 480 volts and below.

Substations may be equipped with any of several suitable transformers manufactured by Pennsylvania. Indoors, sealed dry-type, ventilated dry-type, or askarel-filled transformers are used. Outdoors, oil-filled transformers normally are used.

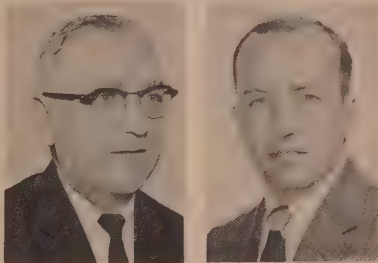
#### Switchgear Features "Tilt" Design

Outgoing feeder switchgear—normally of the 600-volt insulation class—may include either low voltage power circuit breakers or molded-case breakers. A feature of Pennsylvania's draw-out switchgear is a special breaker-tilting arrangement that provides easy access for adjustment of trip settings.

The various types of switchgear also are available as separate assemblies for subsidiary distribution centers.



*Pennsylvania's Transformer's new line of secondary unit substations includes both indoor and outdoor substations, both articulated and integrated designs. Pictured is a 1000-kva articulated, indoor substation rated 4160—480Y/277 volts. The substation includes a primary, fused, air interrupter switch, an askarel-filled transformer, and secondary drawout switchgear with a special "tilt" breaker design.*



J. J. Zimsky

T. S. Banghart

### Sales, Production Heads Named for Pennsylvania's Unit Substation Department

A product manager and a sales manager have been named for Pennsylvania Transformer's new secondary unit substation department. Product manager is J. J. Zimsky, who formerly headed the company's planning department. Sales manager is T. S. Banghart, whose experience includes six years as switchgear application engineer.

### Introduction of New Products A Habit at Pennsylvania

A check of the records today revealed that new product announcements are by no means uncommon at Pennsylvania Transformer Division, McGraw-Edison Company. Counting the latest announcement, regarding secondary unit substations and low voltage switchgear, at least three such announcements have been issued by the Canonsburg, Pa., manufacturer within little more than a year.

The other two announcements involved the Pole Star Regulator (introduced in 27 single-phase distribution ratings) and the Pennsylvania Phase-Isolated Load Tap Changing Transformer. A Pennsylvania innovation, the Phase-Isolated LTC is a three-phase transformer that features individually controlled voltage regulation for each phase.

In addition to secondary unit substations and low voltage switchgear, Pennsylvania products now include a complete line of transformers and regulators, from the smallest pole-type to the largest station units being made today.

(Advertisement)

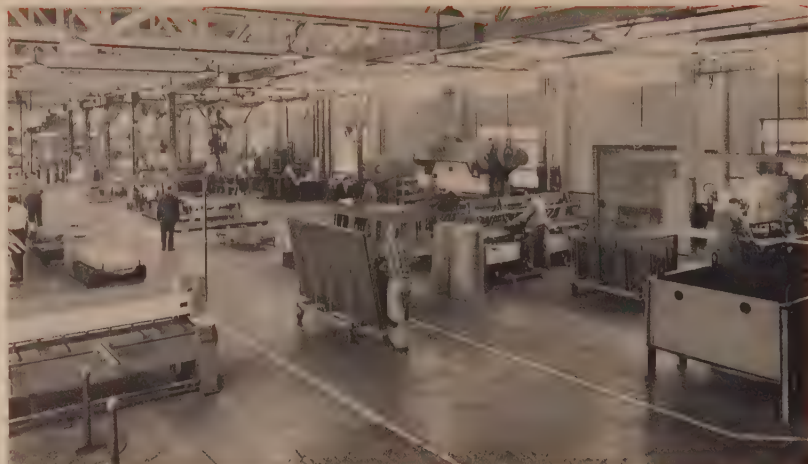


# PENNSYLVANIA UNIT SUBSTATIONS DESIGNED, ENGINEERED AND MANUFACTURED UNDER 1 ROOF

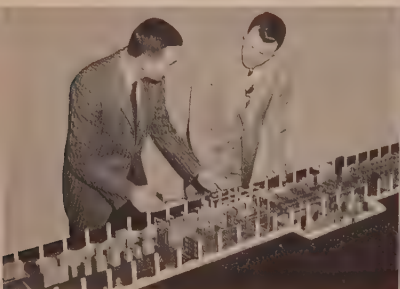
## Centralized Responsibility Assures Coordinated Shipment

From development to production, all components of Pennsylvania Secondary Unit Substations are designed and engineered under one supervisory helm. Switchgear and transformers are sure to complement each other in both appearance and quality. In addition, ease of field installation is assured.

With manufacturing and assembly of all switchgear assemblies and transformers being handled at one plant, completely coordinated production is assured. All components can be shipped together, thereby avoiding delay at the installation site.



*A portion of Pennsylvania's unit substation production floor, showing some of the sheet-metal-working machinery in the foreground.*



*Above left: Before beginning actual work on Pennsylvania's unit substation and switchgear facilities, special engineers and planners studied scaled model layouts as shown here. Above right: Coordinated shipment of substation components is the rule at Pennsylvania Transformer. Switchgear assemblies and transformers are produced at the same plant.*



## Equipment Laid Out for Streamlined Production Flow

A highly efficient, completely new production-line arrangement has been established for Pennsylvania unit substations and switchgear. All equipment and layout re-

quirements were predetermined by specialized engineers and planners.

Detailed models of all equipment, arranged in a scaled factory layout, were of

tremendous benefit, the company reports, in determining the choice of machinery, the flow of materials, and even the selection of colors for equipment and walls.

## OVER 30 YEARS' EXPERIENCE IN TRANSFORMER MANUFACTURE INCLUDES MANY SUBSTATION APPLICATIONS

In more than 30 years of transformer design and manufacture, Pennsylvania Transformer Division, McGraw-Edison Company has produced every type of transformer from small distribution pole-type units to the largest size power transformers. To date, transformers have been manufactured in capacities over 300,000 kva and in voltages up to 460 kv.

Many transformers have been produced in the past for use with secondary unit substations assembled by other switchgear manufacturers. Thus, Pennsylvania enters the secondary unit substation field with a

substantial store of information and experience regarding the applications involved.

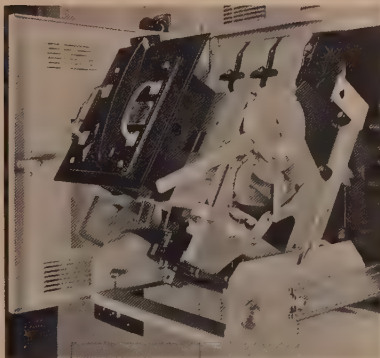
### Production of LTC Equipment Prepares Personnel for Manufacture of Secondary Unit Substations

In addition, Pennsylvania Transformer has a nationwide reputation for quality in various other related fields, such as the design and manufacture of load tap changing equipment and other types of transformer switches. Single circuit primary unit substations have been a Pennsylvania product for many years.

Experience from the manufacture of such a wide variety of equipment has developed in Pennsylvania a large pool of engineering knowledge and production know-how. Personnel has been well trained to handle the manufacture of secondary unit substations.

### Pennsylvania Transformer Assumes Complete Responsibility for Materials and Workmanship

The Pennsylvania Transformer Division of McGraw-Edison Company assumes full responsibility for all materials and workmanship in its new line of secondary unit substations. The company points out that this is the long-established policy for all Pennsylvania products.



Breaker withdrawn and tilted back to give easy access to trip units without completely removing breaker element from carriage.



Close-up showing how breaker is racked into connected position. Breaker must be opened and positive interlock released before breaker can be moved.

## Tilt-back Feature Facilitates Inspection and Maintenance

Several unique features have been incorporated in the design of Pennsylvania's draw-out carriage and racking mechanisms for power circuit breakers.

In the withdrawn position, the breaker can be tilted back on its rear trunnions so that the trip elements and other parts below are easily accessible for maintenance and adjustment.

The racking mechanism is operated with a self-storing captive handle. Not only are positions positively indicated, but also the mechanism is positively locked in all positions: "CONNECTED," "TEST," and

"DISCONNECTED" — and the breaker cannot be closed between these positions.

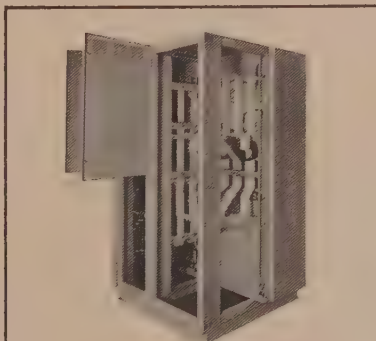
Before the racking mechanism can be operated, it must be unlatched with a finger lever. Movement of this latch is blocked when the breaker is closed. In any intermediate position of the racking mechanism, the trip lever is held in the operated position, preventing closure of the breaker.

The compartment door can be closed with the breaker in any position. A frame, under spring pressure around the mechanism throat, moves back, allowing the mechanism to extend beyond the compartment.

## L V Switchgear Assemblies Are of Unitized Construction

Indoor assemblies for the outgoing feeders of Pennsylvania secondary unit substations are of sectional construction, with a stack of breakers in the front compartment and a bus structure in the rear. All parts are made of formed, sheet steel, spot welded together when possible for utmost strength and rigidity. Sections, as required, are bolted together and to a rigid, structural-steel base frame designed to permit easy movement of the equipment.

When the switchgear is for outdoor installation, a weatherproof outer "skin" is added to provide an operating and maintenance aisle in front of the breakers. All joints of this outer steel inclosure are gasketed to make them water- and dust-tight. Doors, equipped with 3-point latches and 3-point hinges, are fully gasketed. Ventilating openings have metal flaps that are easily removed for cleaning.



Rear view of main breaker compartment.



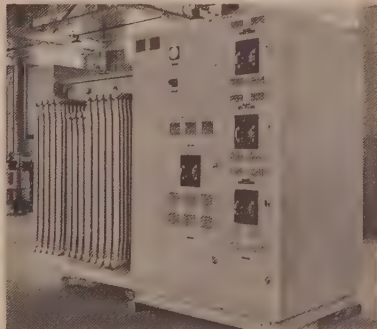
Outdoor switchgear with walk-in aisle.

### Indoor Integrated Substation



Pennsylvania secondary unit substation rated 500 kva, 2400 — 208Y/120 volts. The transformer is a ventilated dry-type.

### Indoor Articulated Substation



1000 kva, 4160—480Y/277 volt substation, with askarel-filled transformer, 1600-ampere main secondary and 600-ampere feeder breakers.

### Outdoor Articulated Substation



This outdoor substation with oil-filled transformer is rated 1500 kva, 12,470—480Y/277 volts.

### Complete Range of Sizes Now Available

The new line of secondary unit substations announced today by Pennsylvania Transformer Division includes both indoor and outdoor types, articulated and integrated design. Available sizes are:

Articulated—112½ through 2000 kva

Integrated—75 through 500 kva

Supply-side voltage ratings normally are from 2400 through 13,800 volts, with load-side voltages 480 volts and below.



# Vacant Breaker Position Easily Converted for Use



Front view, circuit breaker cradle and carriage assembly.

Breakers can be easily installed in the vacant compartments of Pennsylvania secondary unit substations. The blank back plate is removed, permitting a jig-assembled breaker cradle and carriage to be inserted and bolted into place. Jumper bars are installed between the bus and the stationary breaker terminals of the cradle.

If desired, any compartment can be equipped with a cradle and carriage already installed, and the breaker element can be added when needed.

## Variety of Incoming Line Sections Available



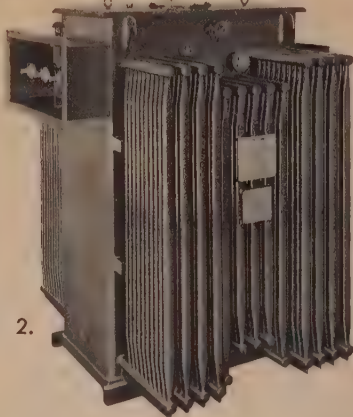
Outdoor fused interrupter switch with weather-protected aisle.

Supply circuits for Pennsylvania secondary unit substations can be terminated in any one of several types of primary switchgear, the company reports. Frequently used is an air interrupter disconnect capable of opening the normal load on the substation. Power fuses are often included with the switch. Lightning arresters can be connected to these circuits for protection of the transformers.

Fused switches are arranged so that the fuses are not accessible until the switch is opened. Outdoor inclosures have weather-protected aisles to permit maintenance and changing of fuses during adverse weather.



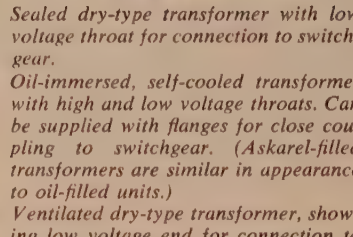
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2.



3.



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## Four Main Transformer Types with Selection Depending on Application

The location and conditions of the installation determine the type of transformer selected for Pennsylvania secondary unit substations.

For indoor installation, dry-types are commonly used — either open ventilated or sealed. Another type used with indoor sub-

stations is the askarel-filled transformer. Each of the three has its own special qualifications for particular locations.

For outdoor installations, oil-filled transformers are used most often. Under special conditions, it is advisable to use askarel-filled or sealed dry-type transformers.

## Pennsylvania . . . A Leading Manufacturer of Transformers for over 30 Years



Since the company was founded in 1929, Pennsylvania Transformer has grown steadily, during the years of the depression as well as in the boom times that followed. From the standpoint of quality as well as production, it has maintained its position as one of the leading transformer manufacturers in the country.

Pennsylvania Transformer became a division of McGraw-Edison Company in 1952. All manufacturing facilities—comprising nearly one million square feet—are located in Canonsburg, Pa., 18 miles south of Pittsburgh. The plant is shown at left.



### Write for Copy of Pennsylvania Secondary Unit Substation Book

This well-illustrated 44-page booklet contains descriptions of secondary unit substation and switchgear components, as well as application data. Write on your company letterhead.

**PENNSYLVANIA TRANSFORMER DIVISION**  
**McGRAW-EDISON COMPANY, CANONSBURG, PA.**



# Practical Methods



**OPEN CONSTRUCTION** and louvered shielding of this tandem fixture provides even distribution and glare-free lighting for telephone switchboard operators. Inclination of message slots helps shield vertical illumination on pilot-light panels, although 40 fc obtained on horizontal keyboard is ample for accurate reading and writing of messages.

## Semi-Indirect Fixture Obtains Dual Objective For Telephone Exchange

Switchboard illumination, of necessity, is a compromise. First, it must provide sufficient light on horizontal surfaces to permit accurate reading and writing of messages, while secondly, it must keep intensities on vertical surfaces sufficiently subdued so that pilot lights will be clearly visible to operators. Moreover, to minimize eye fatigue, distribution must be uniform and glare-free with an absence of wide brightness contrasts.

Such were the specifications when electrical contractor F. A. Schlicher of Van Nuys, Calif., was requested to light that town's local around-the-clock telephone-answering exchange. He recommended a 90% indirect system that incorporated stem-suspended louvered fixtures as the source medium.

In this tandem-lamp Smoot-Holman installation, snap-in cellular bottom panels provide 40-degree shielding both laterally and longitudinally. And, although suspension is only 12 in. from the ceiling, distribution and resultant quality of the lighting is completely satisfactory. Lamps are cool-white 8-ft slimlines operating at 430 ma and, with reflectances of surrounding areas kept high, intensities both on vertical and horizontal working surfaces fulfill the initial dictates.

As noted on the accompanying

photo, vertical illumination on message slots (indicated by the key-letter V) ranges from 18 to 27 fc, while H-keyed horizontal intensities on plugboards and tables vary between 35 and 40 fc. With the exception of the board itself, surrounds are light in tone, buff ceiling, green walls, tan floor tiling and grey furniture having reflectance factors of 65, 60, 50 and 75% respectively. Cool-white lamps were selected to counteract possible psychological reactions that might relate to the use of "warm" lamps in this relatively small room.

As can be seen in the picture, design of the fixture is clean and open with ballasts mounted between tandem sections in cross-over channels, and with circuit wiring (TW rather than AVA) segregated in horizontal raceways placed parallel to lamps. Mounting ballasts in this manner has three plus values, for operating temperatures are slightly lessened, ballast life is correspondingly improved, and lamp output is kept high.

The installation was simplified through the use of adjustable-stem swivel hangers attached directly to standard outlet boxes, for it was then necessary only to secure fixtures to hangers and connect the pre-installed service leads.

Maintenance is likewise simpli-

fied due to the open design of the unit, for few horizontal surfaces are available for dust collection, plastic louvers may be quickly removed by pushing them up and moving them laterally, and lamps can remain in their sockets while they are given a "once over" with a detergent-dampened cloth.

This installation is an inexpensive one and relatively modest (8.3 kw), yet the slender lines of the fixtures are attractive and the open construction minimizes obstructions to light reflected from the ceiling. It is therefore commended for placing practical lighting values within reach of moderate budgets.

## Multiple Substations For Hospital System

Use of six small packaged substations, instead of one or two large units, has improved continuity of service and has afforded lower cost protection and better operating economy as bonuses in a recent expansion of electrical distribution facilities at Bryn Mawr Hospital, Bryn Mawr, Pa.

This major electrical construction triples the hospital's available power and will accommodate planned future expansion. The substations transform incoming high-voltage power to distribution voltages.

The substations are completely pre-engineered load centers con-



**OUTDOOR SUBSTATIONS** are part of a system of six 4160-volt subs supplying light and power to a modern hospital. Both indoor and outdoor units are used, with a secondary tie connection between a pair of 150-kva units and a tie between a pair of 225-kva units.



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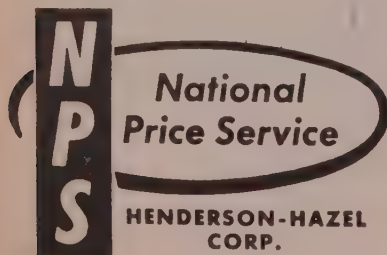
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taining transformer and primary and secondary control and protection equipment. Because they are packaged units, a minimum of installation time is required and no special engineering is needed.

Significant advantages accrued to Bryn Mawr because of these features of the modernized system:

1. Continuity of service. Use of several small units permits switching loads between units—away from one which has lost power to one still energized—to assure that electrical service is maintained in emergencies.

2. Low-cost protection. Because each of the smaller units carries a smaller load, inexpensive molded-case breakers were used for secondary protection instead of more expensive large air breakers.

3. Operating economy. Unit subs are placed close to load areas, allowing power delivery at higher voltages and lower line losses.

Prior to the modernization, Bryn Mawr Hospital's total incoming power capacity was 900 kva, of which 450 kva was in immediate need of replacement because of age. Also, the recent addition of a new wing and general increased use of electrical power made expansion and modernization of the electrical system mandatory.

The new system now provides a total capacity of 1650 kva—ample for present needs and well into the future. When this becomes inadequate, however, additional substations can be added to the system to increase capacity to virtually any desired amount.

Two pairs of unit subs, supplying lighting and power circuits are located inside and outside the main hospital building. Each pair consists of a 150-kva unit and a 225-kva unit. Like units are connected by bus ties which permit transferring loads either way in case of a power failure on one unit, thereby assuring continuity of service.

An outdoor 225-kva unit is located at the boiler house to supply it with lighting and power service. In an emergency, this unit can handle part of the hospital's load. The sixth unit, a 225-kva substation, is located in the maternity building—supplying lighting and power services to this building.

All indoor sub units incorporate ventilated dry-type transformers. Outdoor units employ askarel-filled transformers. The electrical system modernization was designed by United Engineers & Constructors Inc., and installed by H. B. Frazer & Co., Inc., both of Philadelphia.

## Cable Pulling Made Easy

The following is a description of how a job foreman in charge of wiring a 24-room electrically heated school in Anderson, Ind. pulled in feeders between the building's main distribution panel and three secondary distribution centers. The feeders consisted of three 2½-in. and one 1½-in. conduit runs, and each contained four No. 3/0 RH and four No. 3 RH cables respectively. The runs varied in length from 95 to 200 ft.



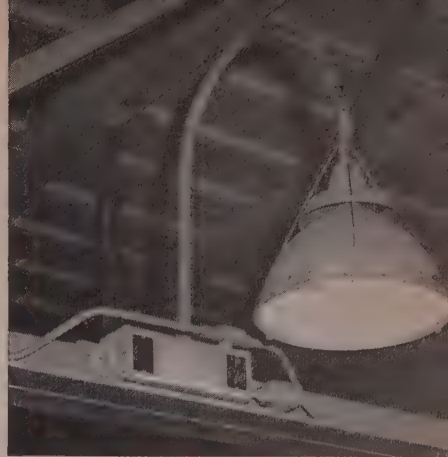
**BENCH-TYPE PORTABLE THREADER** with power-drive extension plus winch mounted to a home-made angle-iron stand were two of the tools employed to make the difficult wiring pulling task easy. Operator of the motor driven unit is in constant communication (via battery-operated telephone set) with second worker feeding cables into the conduit run.



**WORKMEN** pose with ingenious method they devised to cut time and fatigue on a long pull of four No. 3/0 RH cables in an electrically heated school building in Anderson, Ind. The cables were measured and cut—away from the actual pull-in point—then hauled to the pull-in location on a 36-in. payoff reel carried on the bed of a pick up truck. Cables were disbursed directly from reel to conduit run.



*Twenty-four 1000w color-corrected mercury lamps, spaced on 20 x 30 ft. centers, are mounted 50 ft., 6 in. above floor. Maintained illumination is 30 footcandles. Installation — Metropolitan Edison Co., Reading, Pa., Portland Station. Electrical Contractor—H. N. Crowder Co., Engineers and Consultants—Gilbert Associates, Inc.*



*Sola transformer No. 77020 maintains rated lumen output of H15 lamp in Holophane fixture within  $\pm 1\%$  even if primary voltage should vary over 200 to 260v range.*



*Newest line of indoor Sola constant-wattage mercury-lamp transformers features light weight, improved case construction; starts mercury lamps down to 20° below zero.*

## Sola-ballasted mercury lamps specified for new generating station

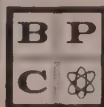
Here are five performance benefits that make Sola constant-wattage transformers pay off in modern mercury lighting installations: Light output is constant within  $\pm 1\%$  with line voltage changes as great as  $\pm 13\%$ . Line-current starting surge is limited to normal operating value—eliminates need for heavier wiring, time-delay relays. The constant-wattage circuit limits primary current under abnormal conditions—lamp failure or secondary short circuit will not overheat the transformer. Stable operating conditions insure rated lamp life. Line voltage must dip 30% below nominal before lamps extinguish.

The utility's engineers and consultants recognized these benefits and specified constant-wattage transformers. Consult your Sola lighting representative for further information, or write for Bulletin MV-396.

# SOLA

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**CLOSE-UP** of payout reel used to speed installation of the 200-ft sub-distribution cable run. The 36-in. payout reel holding a large coil of pre-cut 3/0 cables was transported to the pull-in site straddling the bed of a pick up truck.



**WORKMAN** stationed at a cable pull-in point lubricated cables and guided them into the conduit. During the entire "pull" workers were in constant communication via battery-operated telephone set.

Tools selected for the operation were (1) a winch fitted to a home-made angle-iron stand; (2) a bench-type portable threader with power-drive extension; (3) one set of battery-operated hand telephones; (4) a 36-in. payout reel mounted on a 6-ft skid frame; (5) cable lubricant; (6) a 200-ft conduit fish tape.

Because all of the cable runs were pulled-in in almost the same manner this discussion shall be confined to just one of the runs. This was the longest pull, and the most difficult.

To begin with, a fish tape was pushed from the secondary distribution center to the main entrance panel (200 ft distant). When the eye of the tape emerged from the conduit in the main electrical closet, workers attached it to the end of the wire cable wound on a (previously set in place) winch. The fish tape was marked (to determine the exact length of the run), then pulled out. This procedure accomplished two goals; not only was the exact length of the run deter-

mined, but as the tape was withdrawn from the conduit the winch's wire cable was pulled in. The next step was to cut four lengths of No. 3/0 RH cables from a large reel in the all-purpose room.

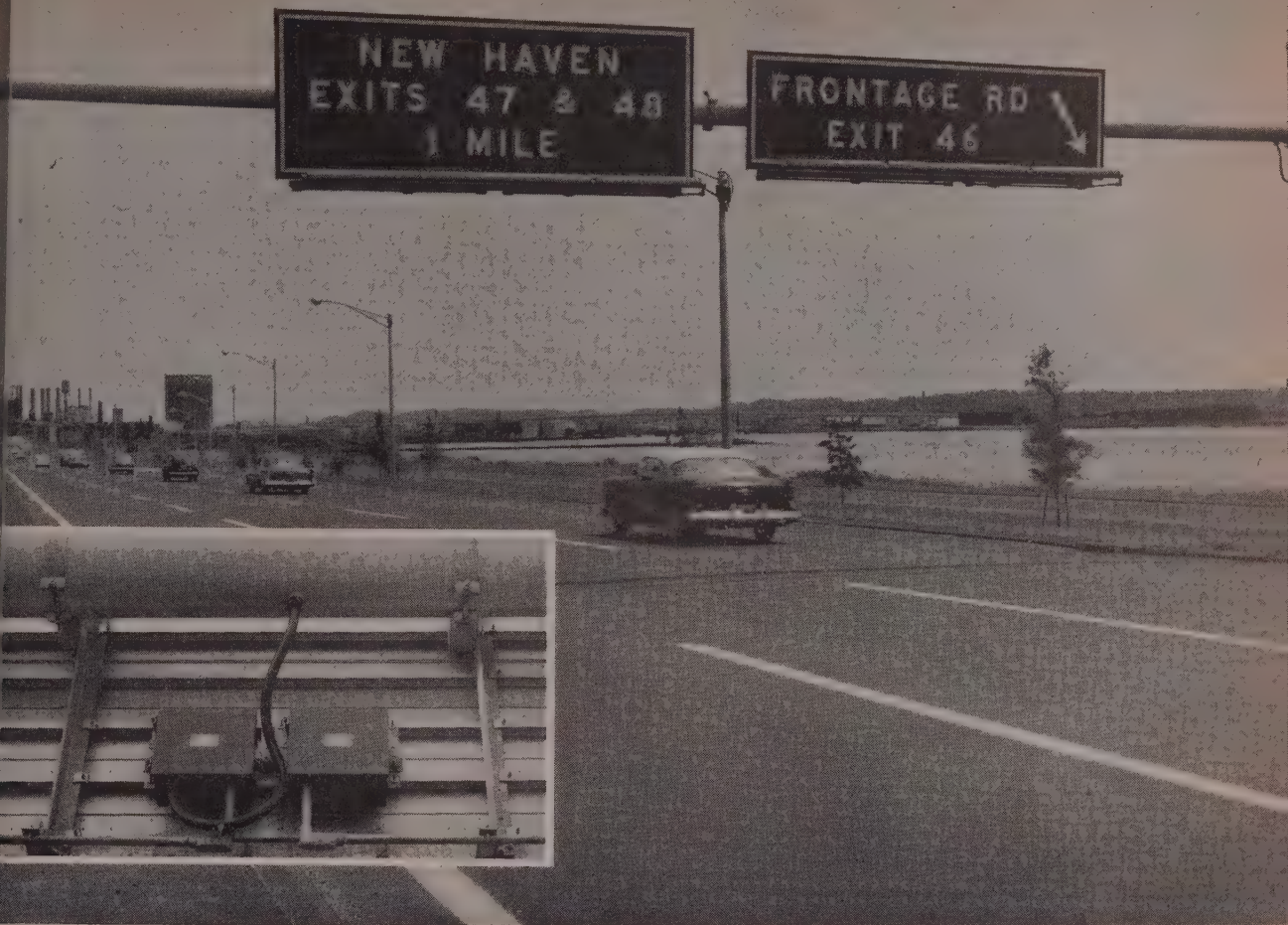
Since the all-purpose room was spacious and because the large cable reel was mounted on a de-reeler stand, this task was quickly accomplished. The lengths of each of the four cables were accurately measured by using the previously marked fish tape (allowances were made for junction and termination purposes). After each of the four cables was measured and cut, they were rolled into a large coil.

However, the secondary distribution center where the cables were to be pulled in was not in the same wing as the all-purpose room (where the cables were de-reeled and cut). This meant that the cables would have to be transported to their pull-in point. Here's where a bit of ingenuity paid off. The coils of No. 3/0 RH cable were placed on a 36-in. payout reel that was mounted to a 6-ft skid frame. The payout reel was then carried to a waiting pick up truck and placed on the sides of the bed of the truck in a straddling position. Then the truck was driven across a court yard between the two wings and backed-up against a window-wall adjacent to the cable pull-in point. From this point the cables were easily pulled from the truck-mounted payoff reel, through a window, across the room to the sub-distribution center.

The final step prior to the actual "pull" took place in the main switchgear room where the power drive extension of the motor-driven threader was connected to the winch. With this accomplished, a final check was made at both ends of the pull; then the two workmen took their respective positions. The battery-operated telephone set provided direct communication between the two men.

Photos show the difficult wire-pulling task executed by just two men, which of course would have been impossible without the aid of the carefully selected tools and methods employed on the job. For example, one worker (in constant communication with the second workman via the battery-powered telephone set) operated the power device that drove the winch, while the second worker, stationed at the pull-in point, lubricated and guided the cables into the conduit. The contractor was Martzolf Electric Co., Kokomo, Ind.





## AN EASY WAY TO EXIT OUTDOOR ELECTRICAL TROUBLES —SEALTITE FLEXIBLE, LIQUID-TIGHT CONDUIT

To make sure overhead exit signs stay lit even in the worst weather, the Connecticut State Highway Department protects sign wiring with Sealtite on the modern 129-mile Connecticut Turnpike.

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**WHERE TO GET SEALTITE** — Leading electrical wholesalers stock Sealtite in easy-to-handle coils, in black or gray. Be certain you ask for and get the quality conduit marked "Sealtite" and "Anaconda" on the cover. Buy it in long lengths on reels or in cartons and cut it on the job to eliminate waste. Your wholesaler also stocks liquid-tight connectors. Free Booklet S-542 gives full information on Sealtite. Write: Anaconda Metal Hose Division, The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. Sealtite is approved by Canadian Standards Association.

59143



**CUTAWAY OF Type U.A.** Sealtite shows tough polyvinyl chloride jacket over flexible metal core. Copper conductor wound spirally inside conduit provides positive ground.

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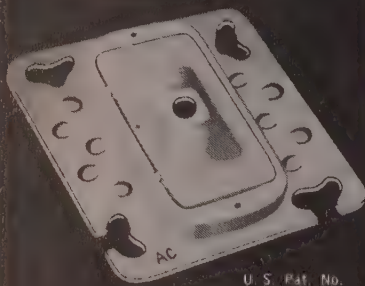
## Case of the Missing Outlet Box...

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## PLASTER GUARD COVER

for 4" Sq. & 4-11/16" Sq. Boxes



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- Plaster Guard prevents plaster from entering box.
- Raised section easy to locate after plastering.

Work with cleaner outlet boxes, free from usual plaster fill-in. Raised Plaster Guard section is easy to pry out. Available on all Arrow 4" Sq. and 4-11/16" Sq. covers.

Write for detailed information.

**Skill & Experience** — active ingredients in all Arrow products.

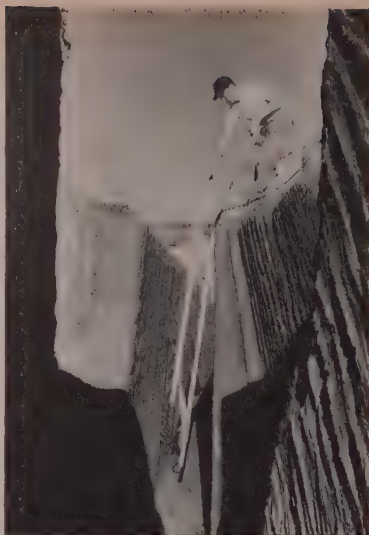
## ARROW CONDUIT & FITTINGS CORP.

129 30th Street, Brooklyn 32, N. Y.

OUTLET BOXES • GANG BOXES • COVERS • BOX SUPPORTS



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**SHORING DEVICE** may be installed from top of trench, with remote portable pump used to motivate cross-bracing hydraulic jacks. Removal of units likewise can be accomplished from above, while folding feature of device permits easy handling and compact storage.

## Lightweight Shoring Members Installed from Outside Trench

Fast, safe trench shoring on several underground feeder projects in the San Jose, Calif., area is being accomplished through the use of sturdy, integrally operated assemblies consisting of two opposing upright members separated and supported by hydraulic jacks. Since vertical members are formed from 8-in.-wide extruded aluminum alloy channels, units weigh less than wooden timbers and they are also less subject to warping or deterioration caused by moisture.

Due to their lightweight construction, they may be easily installed by a single worker remaining at the top of the trench as he follows the digging machine. They likewise may be retracted from the top of the trench and folded compactly into units measuring less than 6 in. in overall thickness, thereby facilitating easy handling and storage.

These several features speed installation and eliminate hazards which might possibly relate to personnel entering excavated areas to install or remove heavier shoring members in soft ground locations.

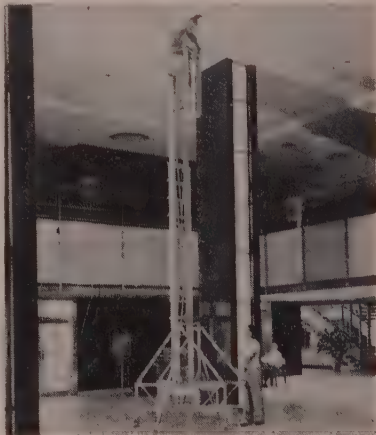
Shoring pads are connected together by hydraulic cylinders which can effectively brace trench walls 28 in. apart. Or, if extension rods are used, ditches as wide as 6 ft can be shored with equal safety.



**EXTRUDED ALUMINUM** shoring pads may be locked to prevent tampering or lessening of lateral pressure if left in place for a long period. Installation and removal of units from above bypasses possible hazard of sliding earth with workers in unshored soft-soil areas.

Cylinders are connected to shoring pads by hinges to permit folding. And, if it becomes necessary to leave jacks in place for a considerable length of time, they may be locked to prevent tampering and to maintain lateral thrust.

The device, designed by Sigma Engineering of San Jose, is braced by means of a portable pump, operated remotely from above.



**RELAMPING TIME** was reduced 50% in the First National Bank Building, Denver, Colo., through the use of a telescoping work platform. 52 incandescent recess downlights in two 24-ft high wells were relamped by two men in only three hours by replacing conventional ladder scaffolds with a telescoping aluminum work platform on wheels. Moved with the job and folded down to roll through doorways, the structure eliminated three hours of scaffold assembly, tearing down and assembly according to the contractor, Fluorescent Maintenance Co.



Westinghouse  
local service speeds  
Miami Airport electrification

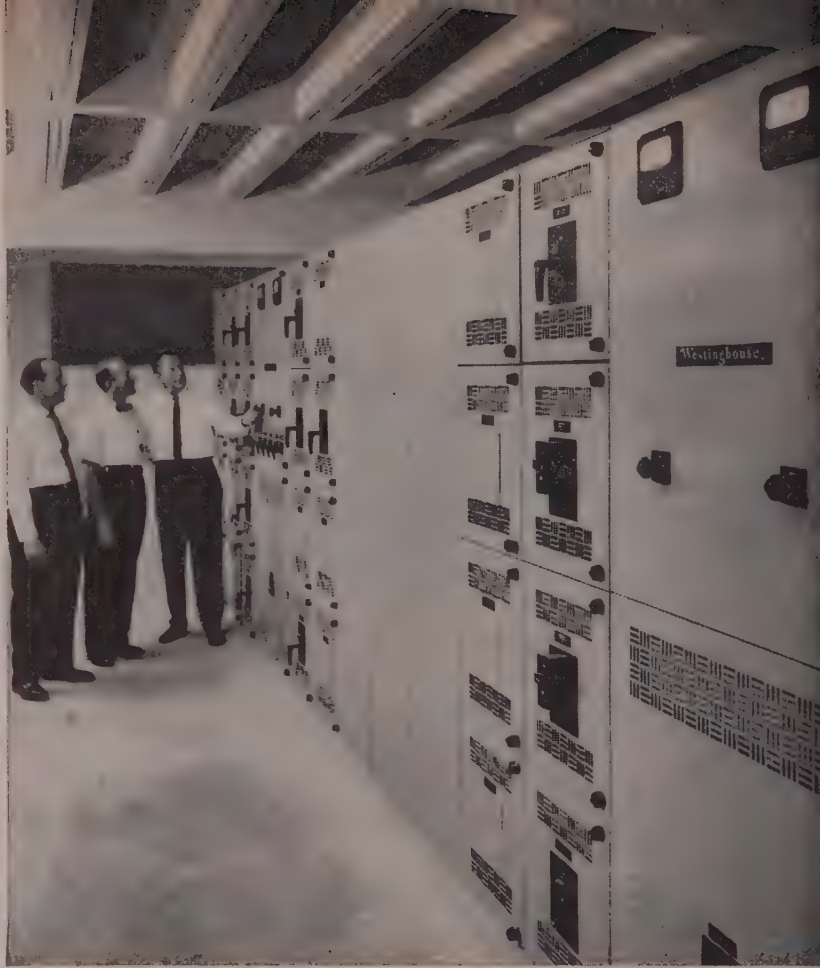
YOU CAN BE SURE...IF IT'S **Westinghouse**



COVER PHOTO: Westinghouse OV-25 mercury-vapor fixtures, with Westinghouse 400-watt color-corrected mercury-vapor lamps, mounted in tandem on standard with transformer base. Shield is Westinghouse design to give complete light control. Discussing airport plans are: George Smith, Howard, Needles, Tammen and Bergendoff, Consulting Engineers; A. K. Ries, Rader and Associates, Design Engineers; James L. Hyland, WESCO sales representative; Charles W. Butsch, Westinghouse sales representative; and Paul Schneider, Job Superintendent, Atlantic Electric, Inc., Electrical Contractors.

Jack E. Mitchell and Leonard Gordon of Mitchell-Gordon Associates, Design Engineers; and Charles Butsch, Westinghouse, examine Westinghouse low-voltage, metal-enclosed drawout switchgear, with Type DB-100 main breakers, DB-50 and DB-25 branch breakers, serving Consumer Service area of new airport. Standardized in design, factory-assembled, factory-wired and factory-tested, Westinghouse switchgear provides lower contractor installation costs by eliminating many on-the-job labor costs.

J-94124-2



Charles W. Butsch, with W. F. Stainton and S. R. Insalaco of Florida Power and Light Co., inspects three Westinghouse vault network transformers (Space-miser design) which furnish power to Consumer Service Building of terminal.



Night shot of "deplaning passenger area," showing the broad expanse of walk and driveway, designed to make airport one of the most serviceable and convenient in the world. Westinghouse industrial-type lights, 2SVP-75, 4- and 8-foot lengths, give maximum light levels, require practically no service and are designed for the quickest, most economical installation.

# Coordination of Westinghouse equipment meets needs of multiple electrical contractors and consulting engineers

Air passenger traffic in and out of Miami, Florida, moves through one of the largest and most modern central-type airports in the world—the new Miami International Airport. Developed and operated by the Dade County Port Authority, and known as the “Gateway to the Americas,” this big, new facility handles more than 11,000 passengers per day.

During the planning and construction of the new Consumer Service Building and parking field at the airport, Westinghouse engineers and representatives of its local distribution outlet, WESCO, worked closely with the architects, consulting engineers, general contractors, electrical contractors and airport engineers. Westinghouse equipment was specified for the electrical distribution system and for many lighting requirements.

An important part of the construction planning was the careful coordination of electrical equip-

ment deliveries by WESCO so the schedules of the many firms concerned could be maintained.

Westinghouse equipment included transformers, low-impedance bus duct, both light and power panelboards, circuit breakers, fluorescent lighting for indoors, and special-design airport lighting equipment for outdoors. Westinghouse electric stairways were specified to keep traffic moving smoothly from floor to floor and in and out of the terminal.

Illustrated on these pages are photos of the  
(cont'd)

YOU CAN BE SURE...IF IT'S  
**Westinghouse**

**S** Over 250 Pages Westinghouse Data in Sweet's Construction File.

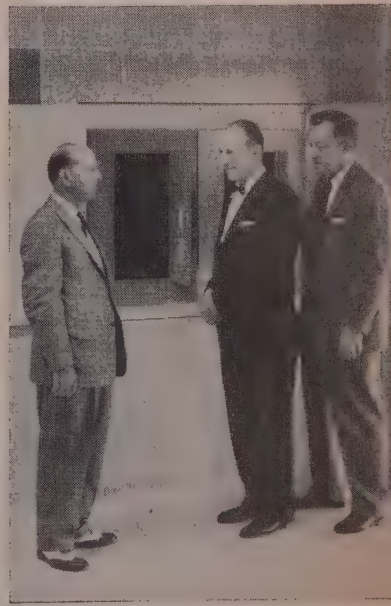
J-94124-3



W. Robert Little of Fred Howland, Inc., General Contractors; Lamar Seay, WESCO sales representative; and Mannie Marlis, President, Atlantic Electric, Inc., Electrical Contractors, examine transformer room installation in Consumer Service Building which includes two Westinghouse 112 ½-kva, DT-3 dry-type transformers and one Westinghouse Type EPT 15-kva, 3-phase unit with circuit breaker. These smaller, lighter transformers are easily handled, quickly mounted, thereby cutting contractor installation costs.



Lamar Seay and Paul Schneider, Job Superintendent for Atlantic Electric, Inc., shown with Westinghouse air conditioning starter, Class 11-750, NS-57, 480-v for one of three 300-ton centrifugal compressors in Consumer Service Building.



Standing before Westinghouse lighting panelboards, Type NLAB, installed behind panels in lobby of enplaning passenger service area in Consumer Service Building, are Harold D. Steward of Steward-Skinner Associates, Architects; Leonard J. Gordon, Mitchell-Gordon Associates; and Charles Butsch, Contractor-Wesco coordination insured prompt delivery of boxes and interiors to meet contractor schedules.





## Coordination of Westinghouse equipment meets needs of multiple electrical contractors and consulting engineers (cont'd)

Westinghouse electrical equipment which helped Power-Up the new Miami Airport for present and future operation, and of some of the many individuals who had a part in its planning and construction.

Westinghouse can help you with any phase of your own electrical planning and construction. See your Westinghouse distribution outlet or write: Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania.

OWNER: Dade County Port Authority

ARCHITECT: Steward-Skinner Associates, Miami, Fla.

DESIGN ENGINEERS: (Outdoor) Rader and Associates, Miami, Fla.  
(Indoor) Mitchell-Gordon Associates,  
Coral Gables, Fla.

CONSULTING ENGINEERS: Howard, Needles, Tammen and  
Bergendoff, Miami, Fla.

GENERAL CONTRACTOR: Fred Howland, Inc., Miami, Fla.

ELECTRICAL CONTRACTORS: (Outdoor) Astor Electric Service,  
Inc., Miami Beach, Fla.  
(Indoor) Atlantic Electric, Inc.,  
Miami, Fla.

ELECTRICAL DISTRIBUTOR: Westinghouse Electric Supply Co.,  
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J-94124-4

ABOVE: Night view of airport ramps and parking area. BELOW: Close-up view showing upper vehicular ramps for enplaning passengers.

Advanced methods and techniques were used to prepare Miami's International Airport for its important role in the new Jet Era. An interwoven network of highways, incorporating overpasses and grade separated interchanges, assures free-flowing traffic to and from the airport. The overhead lights in the huge parking field and upper vehicular ramp have specially designed Westinghouse OV-25 units, over 370 fixtures in all. These fixtures, functional as well as decorative, combine glare-free visibility with the virtual elimination of maintenance.

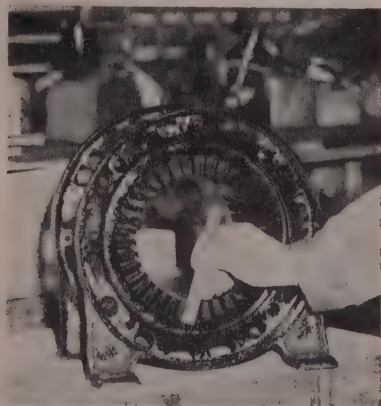




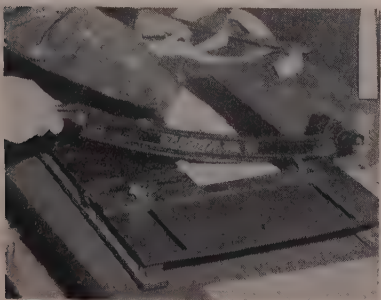
## Slot Cell Crimper Is a Time Saver

Methods used for forming slot insulation liners vary within individual shops—some shop owners and managers have designed their own equipment, others have purchased suitable equipment already on the market; but all have one goal in mind—cutting repair time while still maintaining high quality workmanship.

Clarence Kinsman, manager of the Motor Shop division of Jones Electric Co., Muskegon, Mich., is one of the men who has designed his own equipment for taking the guesswork out of forming slot cell liners. The unit was built by Kinsman in his spare time from scrap parts. Basically here is what it is—and how it works: The slot



**STEP 1.** The length, width and depth of one of the cells of a 5-hp, 3-phase stator in the process of being rewound is measured exactly with a small metal scale.



**STEP 2.** The slot cell lining material for each cell is then cut on an insulation cutter. Exact dimensions are arrived at from calculations using the measurements taken in Step 1.



**STEP 3 AND 4.** After all the required number of cell liners have been cut exactly to size they are formed to fit the stator's cells by inserting them in the home-made slot cell crimper. Two flicks of the workman's wrist is all that's required to completely form each cell's lining.



cell former, more commonly known as a "crimper," fits into a standard bench-type vise. The unit consists of three pieces of  $\frac{1}{4}$ -in. heavy gauge flat steel bars. Two of the bars, which are 4 in. wide by 12 in. long, are bolted back-to-back 1 in. from each end by  $\frac{1}{4}$ -in. bolts fitted with wing nuts. The top edge of the first bar facing the vise is beveled at a 45-degree angle and this forms the bending surface.

A sheet metal spacer (30 mils thick) fitted between the two 4- by 12-in. steel bars can be adjusted up or down (by loosening, then tightening the  $\frac{1}{4}$ -in. wing nuts) to provide the depth needed for the slot liner being formed. When the slot insulation paper has been inserted between the two flat steel bars and is resting squarely on the top edge of the sheet metal spacer (previously adjusted), a third steel bar ( $\frac{1}{4}$  by 2 $\frac{1}{2}$  by 12 in.) that is hinged to the top of the back bar



**STEP 5.** As illustrated here by Mr. Kinsman, a perfect fit is the result of the crimping operation. The pre-crimped slot cell liners, while providing a neater looking job also furnish more area for the stator's coils, which makes them easier to install.

is pulled down to meet the beveled edge of the front bar. This operation crimps the heavy insulation paper. The slot liner is then pulled out and its opposite end inserted and crimped. The process is repeated until enough slot liners have been formed to fill all of the cells of the stator being rewound.

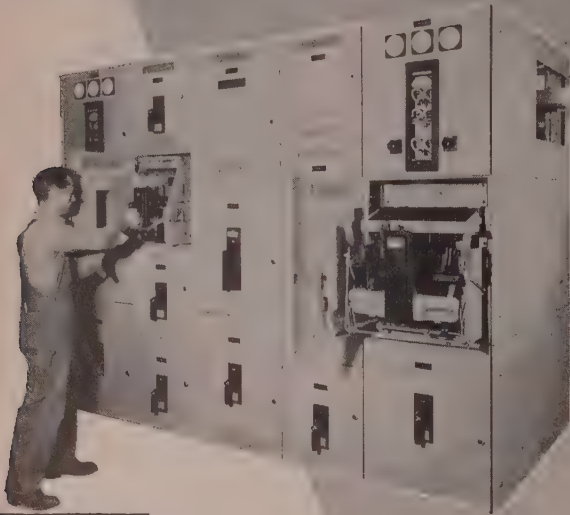
The device Kinsman has constructed and the method he uses to form slot cell liners are illustrated in the accompanying photos.



**FOUR TIERS** of suspended glass jars permit quick identification and visual inventory of small motor parts in Sullivan Electric Company's motor repair department, Cincinnati, Ohio. The 3 $\frac{1}{2}$ -in. by 3 $\frac{1}{2}$ -in. jars screw into metal caps fastened to stepped boards over work tables. Jar labels show parts numbers.



# NELSON LOW VOLTAGE SWITCHGEAR GIVES YOU THE PLUS FACTORS



## CONVENIENCE

Nelson Class 722 Low Voltage Switchgear is completely assembled and tested at the factory before shipment. Field hook-up is fast and simple. All control terminations are located at the point of entrance of control conduits. All control and instrumentation fuses are mounted on the bus compartment door where they are readily accessible.

## SAFETY

Completely dead front. Breaker compartments are separated from each other and from bus compartments by full barriers. Fuse replacement on the door of the bus compartment eliminates entering main bus compartment.



## VERSATILITY

Versatility in choice of components such as breakers, power transformers and instruments. You choose the make you wish to use.

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electrical control equipment  
for industry*

**NELSON *Electric* MANUFACTURING CO.**  
TULSA, OKLAHOMA

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Voltage Switchgear write  
for Bulletin 722.

## Portable Hydraulic Vise

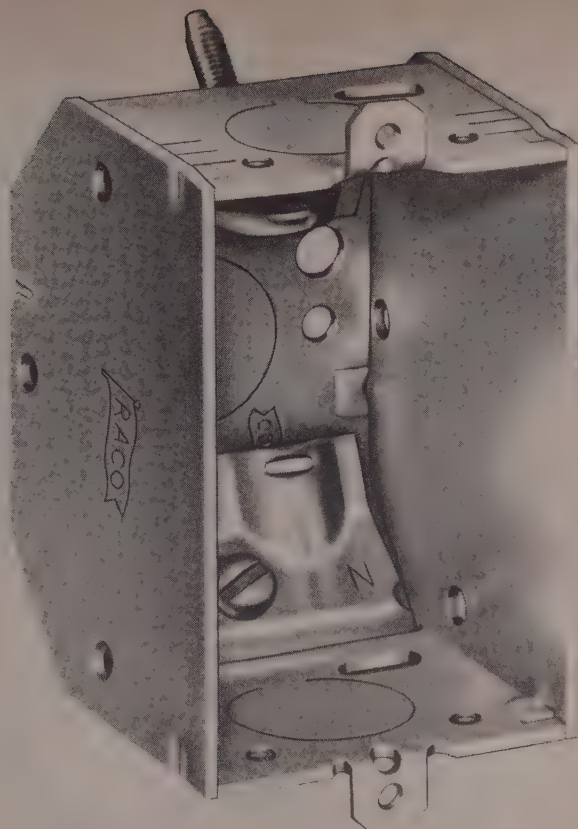
Mobility plus hand-free operation are key features of the bench-type portable hydraulic vise found in motor repair shop division of the Barker-Fowler Electric Co., Lansing, Mich. The foot-operated 4-in. hydraulic vise with its shop designed and constructed portable-type stand has added speed and ease to many operations necessary when rewinding and repairing all types of motors and other equipment.



**EXTENDED HANDLES** and rubber-tired wheels permit hydraulic vise mounted to angle iron stand to be moved to any desired location. Foot pedals operating the vise free mechanic's hands when tapping and sleeving from coil shown in vise's jaws.

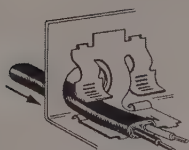


**ANGLE IRON STAND** provides rigid support for 4-in. hydraulic vise mounted to stand's top plate by three 1/2-in. diameter bolts. Arrow points out how extension handles used for moving the vise about are stored when not in use. Angle iron upright installed on back of vise protects hydraulic fluid line running between foot pedals and vise.

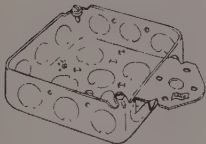


Charlie RACO Says ...

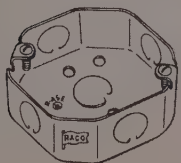
## There's a real difference in RACO boxes...



RACO's complete line of precision clamps meets every wiring need. The new "Q" Quick-clamp is a real time saver. Insert cable ... it's locked in place. No screws to tighten.



RACO's complete line of brackets gives you just the right bracket for any job. All RACO brackets are projection welded for added strength, rigidity.



RACO's K.O.'s and Pri-Outs are easy to remove ... save valuable time on the job.

Your RACO Distributor has the complete RACO line of switch and outlet boxes, covers, bar hangers and set-up boxes. Tell him you want RACO boxes...no other!

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**FITS  
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TYPE  
RECEPTACLES**

The #190 "Tru-Level" adjustable Floor Box accommodates the various new standard styles and sizes of receptacles—all you do is simply clip off plaster ears and drop into specially designed adjusting-ring.

Wire attachment is easily made, without removing the box-body cover—through a 3 1/4" opening, large enough for the hand to fit into.

Adjusting-ring and screw legs make tru-leveling quick and easy.

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National Electrical Industries Show  
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## Non-Adjustable Floor Box



Represents the last word in unique design, neat appearance, fewest number of parts, and least amount of labor to install.

## "Latrobe" Pipe or Conduit Clamp

This clamp is made with a double safety bite of case hardened tool steel.

Two models — Right Angle and the Parallel support. Each model comes in 11 sizes to handle pipe or conduit 3/8" thru 4".



## Latrobe Products

Non-Adjustable Floor Boxes  
Adjustable Floor Boxes  
Gang Boxes—Cover Plates  
Junction Boxes—Nozzles  
Pipe or Conduit Hangers  
Insulator Supports  
Cable Supports—Fish Wire  
Staple and Cable Clips



**ENTERPRISING PARTNERS** Vern Salsberry, Ernie Kirschner and Basil Roach of Whitney Electric Co., Toledo, Ohio, motor repair firm, huddle to analyze a customer's service problem.

The vise is mounted by three 1/2-in. diameter bolts to a 1/2 by 8 by 10-in. steel plate welded to the stand's four 1/2 by 1 1/2 by 1 1/2-in. angle iron legs. The two back legs of the bench-high stand rest on rubber-tired wheels that provide its portability. To move or relocate the vise 1/2-in. conduit extension handles are fitted into two sections of 1-in. conduit welded to either side of the unit at a slight angle to the horizontal plane of its base. A slight up-lift on the extended pipe handles tips the weight of the entire unit on its two rear-mounted wheels permitting the stand to be easily rolled to any desired location. Two upright parallel lengths of 1-in. conduit that are also welded to either side of the unit's frame store the 1/2-in. diameter extension handles when not use.

At the base of the stand a 1/2 by 12- by 16-in. steel plate welded to the unit's frame holds the vise's 3-ft control pedals. The first pedal (left) releases the vise's grip. The middle pedal is for quick adjustment and the third pedal (right) is used to make the vise's grip secure. The 1/2 by 1 1/2 by 1 1/2-in. perpendicular angle iron mounted to the back of the vise stand was installed to protect the hydraulic fluid line running between the vise and its 3-ft control pedals.

Although the hydraulic vise and stand is used for many purposes it is especially useful for holding form coils during their manufacturing process—such as tapping, and putting on sleeving, etc.

With foot pedals operating the vise, the mechanic's hands are free to do tapping and sleeving in the coil while in the vise.

## Roll-About Holds Sleeving Material Coils

A simply constructed but ingeniously devised piece of equipment used to expedite motor repair work at the Electric Maintenance and Repair Co. in Jackson, Mich., is a 6-ft by 5-ft pipe-constructed "A" frame. The unit, mounted on rubber-tired wheels, is built to hold coils of various sizes of sleeving material and lead-in wire. It can be pushed or pulled to any location in the shop where its contents are desired.

The base of the unit consists of two 5-ft lengths and two 2-ft lengths of 1 1/2-in. conduit welded together to form a rectangular frame. Twelve 6-ft pieces of 1/2-in. conduit spaced on 1-ft centers are welded to the two 5-ft sections of the rectangular base to form the "A." Where the 12 conduits (6 on each side) meet at the top of the "A" they are welded to a 5-ft, horizontal length of 1/2-in. conduit.

Actual storage of the numerous sleeving material and lead-in wire coils is provided by hanging them on 3 by 9-in. steel rods that are welded to the 1/2-in. conduit sides of the "A" frame. The rods are spaced 14 in. apart vertically and 12 in. apart horizontally and hold coils of various sizes.

Two 5-ft pieces of 1 by 12-in. lumber bolted to the unit's rectangular-frame base furnish a storage area for reserve coils of popular sizes of sleeving material and lead-in wire. Spare coils are shown in the photo below.



**MOBILE UNIT** was built by the Electric Maintenance and Repair Co. of Jackson, Mich. The "A" frame-type device will hold 60 coils of various types and sizes of sleeving material and lead-in wire. Rubber-tired wheels permit it to be easily moved from one location to another.

**Fullman  
Manufacturing Co.**

1209-1215 JEFFERSON STREET  
LATROBE, PA.



## Flexible wiring system for Jacksonville City Hall with SPANG

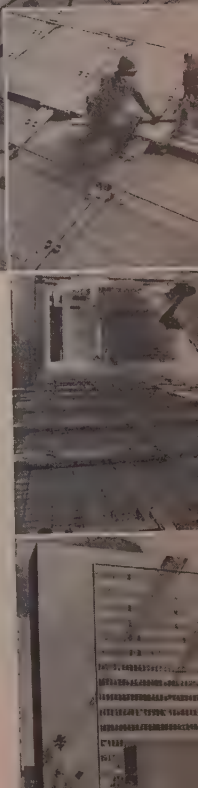
Underfloor Duct and Headerduct. Three-duct runs of Underfloor Duct in concrete slab construction carry electrical, phone and intercom wiring on first floor. Upper 15 floors are served by Headerduct in cellular-floor construction. Simplicity of Spang Raceway Systems provided a time-saving, trouble-free installation. Future wiring changes can be made quickly, easily without costly reconstruction, making City Hall modern for years to come. For full information, write to Spang.

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General Contractor: The Auchter Company, Jacksonville  
Mechanical Contractor: Henley and Beckwith, Jacksonville  
Electrical Contractor: Wesley Paxson Co., Jacksonville  
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Sorgel is historically known throughout the industry as the pioneering designers and manufacturers of quality dry-type transformers. Since 1916 this has been the principal product at Sorgel. Because of this long-time specialization and the experience of our engineering department, you are assured of immediate personal attention on any request or order. The combination of immediate service, product advantages, and competitive prices make Sorgel Electric the first choice of any consulting engineer, plant engineer, contractor or end users wanting a continuous, dependable transformer performance. The people who specify Sorgel are specifying the economies found only in our quiet quality products.



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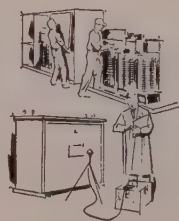
*Prompt, efficient attention to your inquiries, orders and deliveries*

Sorgel's competent staff of experienced engineers, salesmen, sales representatives and factory personnel are trained to serve you immediately when you call. When your inquiry is received it gets immediate, personal attention. Each order is carefully reviewed as to specifications and delivery requirements. Prompt acknowledgment is made and almost immediately your transformer starts through our efficient production scheduling.

## THE SORGEL PLANT

*Where imaginative progress has been, and is being made*

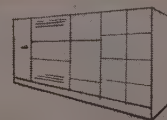
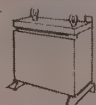
Continued modernization of our facilities and the growth and additions of talented engineering personnel have made possible the many new improvements and developments of our complete family line of sound-rated dry-type transformers. We take pride in keeping ahead of the present pace and engineering for the future. That's why Sorgel is known as the pioneer of sound-rated dry-type transformers for use in all sizes and all voltages.



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*In the Transformer Field, Quality Is Economy*

It's a proven fact that the initial cost of a second-class transformer is usually not the final expense. Breakdowns and extra maintenance costs mount fast. Not with our line! Sorgel sound-rated dry-type transformers are designed and carefully manufactured to provide you with ease of installation, the ultimate in efficiencies assuring lowest operating cost at all loads, overload capacity and long-range economy.



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HERE

The Editor  
ELECTRICAL CONSTRUCTION AND MAINTENANCE  
330 West 42nd St.,  
New York 36, N. Y.

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FOR MORE INFORMATION ON

## NEW PRODUCTS CATALOGS, BULLETINS ADVERTISEMENTS

### ◀ USE THESE CARDS

- **PRODUCT NEWS, PRODUCT BRIEFS:**

Use first line of boxes. Insert item numbers of products on which more information is desired.

- **CATALOGS, BULLETINS AND ENGINEERING DATA:**

Use second line of boxes. Insert item numbers of literature desired.

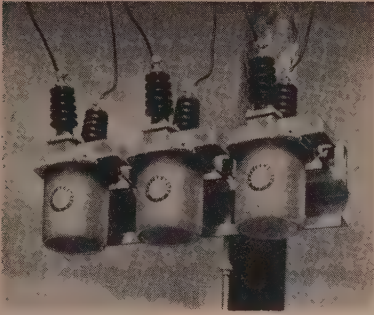
- **ADVERTISEMENTS:**

Use third line of boxes. Insert page numbers of advertisements on which additional information is desired. Where more than one advertisement appears on the page, include the manufacturer's initials.

### IMPORTANT...

- PLEASE PRINT LEGIBLY
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# Product News



**Oil Switch**

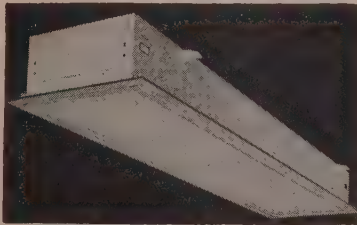
(1)

A new 200-amp, 15-kv oil switch, type CSL, for pole-mounted capacitors, sports field and street lighting, and as a load-break isolating switch on rural and suburban distribution systems. Oil switch is solenoid-operated and requires two cycles to open and six to reclose. Control contacts are mounted above the oil. The 200-amp, 15-kv switch has a 95-kv BIL level, a momentary current rating of 9000 amps, RMS asymmetrical and a one-second rating of 6000 amps, RMS symmetrical. Control voltage is 120 or 240 volts.

Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa.

both compartments. HV compartment has provisions for mounting lightning arresters and potheads. It may contain a fused disconnect-sectionalizing switch for loop feeder service. "Unitran" is available in voltages 15 kv Grd Y and below, in conventional transformers 15 through 167 kva, or in CSP units 15 through 50 kva. The enclosure is suitable for use with comparable ratings of pole type units.

Moloney Electric Co., St. Louis 20, Mo.



**Troffers**

(3)

A new series of fluorescent troffers designed for installation in plaster and many other types of ceilings. Called the "Universal II" series, the units are 5 in. deep and in 4 and 8-ft basic units. They are available for either rapid start or slimline lamps, in a complete range of closures. Troffers are equipped with HPF ballasts and with Buss HLR fuseholders and GLR fuses on all circuits. They are UL listed and ETL approved.

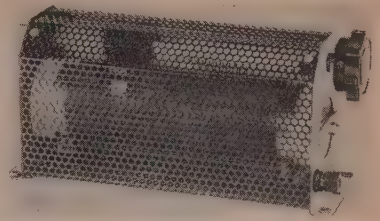
Pittsburgh Reflector Co., Westmoreland Ave., Irwin, Pa.

**Motors**

(4)

Sterlicone multi-shielded motors are designed to operate under adverse conditions of continuous and excessive moisture, high humidity, and temperature, salt spray, dust, oil, and chemically contaminated atmospheres that previously required totally enclosed fan-cooled protection. Flexible insulation is achieved by multiple application and controlled processing of a special silicone sealing compound. Motors are available in all ratings from  $\frac{1}{2}$  hp to 50 hp, any phase, frequency or voltage, torque or slip characteristics, and with multi-speed winding.

Sterling Electric Motors, 5401 Telegraph Road, Los Angeles 22, Calif.



**Rheostat**

(5)

A new 10-in. lubri-tact screw-drive caged Jagabi rheostat is suitable for use in shops, testing departments and laboratories. Metal cages enclose live and hot parts, are attached to prepunched end brackets and enclose top, sides, and bottom of rheostats. The new type of perforated material allows 50% more open area. Mounting dimensions of caged rheostats are the same as for open rheostats. Bulletin 41-6 is available.

James G. Biddle Co., 1316 Arch St., Philadelphia 7, Pa.



**Meter Sockets**

(6)

A new line of 100-amp meter sockets available with either code gauge steel or aluminum enclosures. They are UL approved. Angled lay-in type lugs with pressure plate are approved for copper or aluminum wire, No. 6 through No. 4/0 AWG. Triple neutral also provided with lay-in type lugs, makes possible the use of a combination aluminum and copper wire up to No. 4/0 AWG. Built-in "interference" between cover and enclosure assures continuous ground connection. Both fixed and interchangeable type hubs are available from 2-in. hub size down to no hub. These are of high tensile strength alloy approved for use with both steel and aluminum enclosures and conduit. Bulletin No. 140 is available.

General Switch Co., 45 Roebling St., Brooklyn 11, N. Y.



**Transformer Equipment**

(2)

"Unitran" is designed specifically for use by utilities planning underground residential distribution systems. It consists of a transformer, LV compartment and HV compartment designed to couple with each other in a single unit. Compartments are fabricated of heavy gauge sheet steel and have ample space for connections and entrance of cables. Full width, weatherproof, tamperproof doors are provided on





## ... and for NEARBY SERVICE on Black & Decker

**tools.** Black & Decker maintains 50 factory service branches plus authorized service stations to give your B&D tools the attention mechanical products need periodically. Keep your B&D tools in top condition, on the job all the time.

Only factory parts and factory-approved methods are used. Fast service and reasonable cost, always.



**SWIFTY SERVICE** says  
be sure to ask about:

**FREE TOOL INSPECTION**  
no cost,  
no obligation.

**STANDARD B&D  
GUARANTEE** after  
completion of all  
recommended  
repair work.

You'll find the location  
of the nearest  
B&D repair facility  
in the Yellow Pages under "Tools-  
Electric," or write for address to:  
**THE BLACK & DECKER MFG. CO.,**  
Dept. 1202-S, Towson 4, Md.

50<sup>th</sup> YEAR

See Tools-Electric  
Yellow Pages for  
Service & Sales

**Black & Decker®**

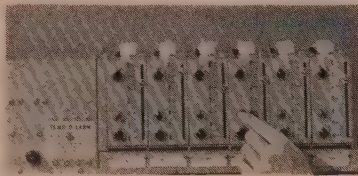
Quality Tool Service



### Stereo-Intercom System (7)

Built-in stereo-intercom high-fidelity music system for use in homes. It is a complete entertainment and communication system with stereo, record changer, AM/FM radio tuner, two amplifiers (in a single chassis), all the inside and outside speakers desired, a built-in record storage cabinet or tape deck, plus high-fidelity intercom. It provides stereo or monophonic sound throughout the house. Each room has selective listening. For instance, two radio programs can be on at the same time or records on channel A and FM on channel B. Intercom is available at all times for room-to-room communication and door answering. Music or radio are silenced automatically when intercom is operated. Remote controls for outside and inside are available. It is adaptable for Multiplex broadcasting and cartridge tapes. All or part of system may be used and auxiliary equipment may be connected, if desired. It is designed to fit standard studding in 4-in. dry or plaster walls.

*NuTone, Inc., Madison and Red  
Bank Roads, Cincinnati 27, Ohio*



### Alarm System (8)

A new device which triggers an alarm when temperatures in production equipment reach an over-heat condition, has been announced. Called Temp-O-Larm, the equipment comprises a thermostat preset to actuate at any desired temperature. When temperature in a production unit reaches the pre-set temperature, it sends a signal to an annunciator which causes audible and/or visible alarms to sound either locally, at a remote location

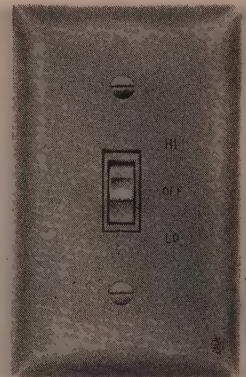
by use of a telephone line, or both. Each annunciator has an alarm time delay that can be set from zero to six hours. One annunciator drive unit will monitor from one to six production units and another unit will monitor seven to twelve. It operates on 115 volts, 60 cycles. Exposed connections are low voltage.

*Kidde Ultrasonic & Detection  
Alarms, Inc., Clifton, N. J.*

### Voltmeter (9)

New narrow range ac voltmeter calibrated from 110 to 130 volts, is intended for utilities, laboratories and other industrial applications where holding voltage to a high degree of accuracy is required. Instrument uses milliammeter element fed by a Zener diode circuit, which spreads 110-130 volts over 95% of scale length. It is available for both 50/60 and 400-cycle duty, and has a response time of two seconds. Two flange dimensions may be obtained: 4½-in. and 8½-in.

*General Electric Co., Schenectady  
5, N. Y.*



### Switch (10)

A new electronic light control switch with three toggle positions for HI-LO-OFF. Called HI-LO Dimswitch, it offers positive fingertip control for modern lighting with no fixed cycle. It replaces any existing switch for incandescent lamps, single and 3- or 4-way switches. It is available in either regular or interchangeable QST size for either single or multiple gang boxes, and they can be used on 2-in. thin-walls, back to back. Wallplates match average existing wallplates in size and shape and are available in multiples ranging from a single switch unit to a 6-switch unit in various positions. Carrying load is 200 to 500 watts.

*Slater Electronics Corp., Glen  
Cove, N. Y.*



# This is the only Impact Wrench

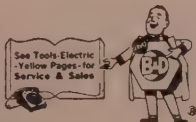
that has the **GUTS** to prove  
its maintenance costs peanuts!

Take an Impact Wrench that's built with extra ruggedness clear through. Take a Factory Service Branch network that keeps accurate repair records. Result: *proof positive* that Black & Decker Impact Wrenches have a phenomenally low maintenance cost.

No other Impact Wrench approaches the Black & Decker because no other Impact Wrench can match the power, speed and maintenance-free construction of a Black & Decker. From drive spindle to reversing ring, every part has been designed to eliminate breakdown problems.

Wherever a bolt, nut, wood or lag screw must be spun, or drilling and tapping done—in machinery moving, installation work, general maintenance or production—a B&D Impact Wrench will do the job faster, with less fatigue, and at lower cost. Mail the coupon or call your B&D distributor for a demonstration.

Leading Distributors  
Everywhere Sell



50<sup>th</sup> YEAR

# Black & Decker®

Quality Electric Tools

THE BLACK & DECKER MFG. CO., Dept. 1202  
Towson 4, Md. (In Canada: Brockville, Ont.)

- ☐ Please arrange a demonstration of a B&D Impact Wrench.  
☐ Please send additional information on \_\_\_\_\_

Name \_\_\_\_\_ Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_



☐ Drills



☐ Hammers



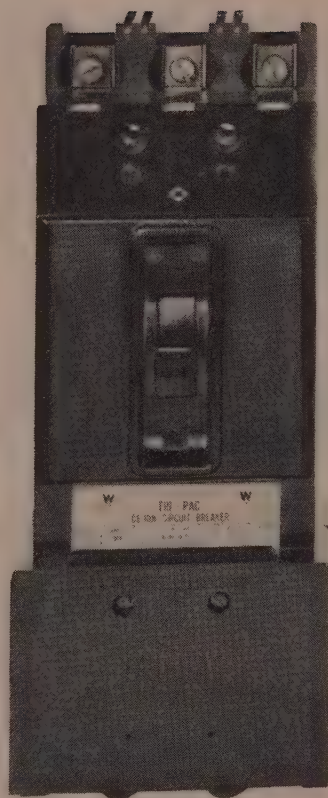
☐ Screwdrivers®



☐ Bench Grinders



# WHO ELSE MAKES THIS MANY TYPES OF CIRCUIT BREAKERS?



TRI-PAC†  
current-limiting breaker for 100,000-amp faults



THERMAL-MAGNETIC  
the industry standard

**NOBODY BUT WESTINGHOUSE!** It's true! Only

Westinghouse offers you six complete lines\* of circuit breakers—to solve six different kinds of circuit protection problems.

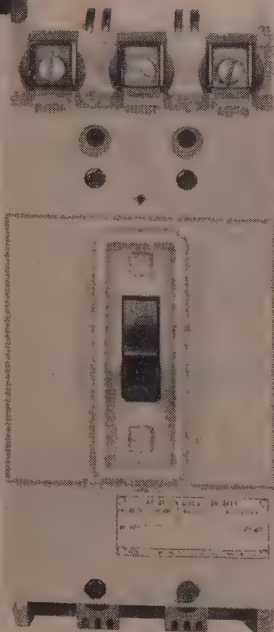
Here's what that means to you: You don't have to accept any "cure-all" type of breaker for your special applications. You can get the right breaker—designed by Westinghouse to do just that special job.

And these aren't high-priced "special" breakers. They're Westinghouse

\*Three of these breaker lines are Westinghouse exclusives!—(Saf-T-Vue,† Ambient-Compensated, MARK 75†)

†Trade-Mark

SAF-T-VUE  
see the contacts are open



AMBIENT-COMPENSATED  
for operation in changing ambients

MARK 75  
75,000-amp interrupting capacity!

FRONT-ADJUSTABLE  
change the setting with a screwdriver

standards—available now in most any frame size, rating or interrupting capacity—in literally thousands of combinations.

We suggest that next time you've got a problem involving circuit protection, call on Westinghouse. Chances are the answer is already in our warehouse. For further information on industry's only complete line of circuit breakers, please contact Standard Control Division, Westinghouse Electric Corporation, Beaver, Pa. Or call your nearby Westinghouse sales office.

J-30263

YOU CAN BE SURE...IF IT'S **Westinghouse**

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV ALTERNATE FRIDAYS





# ROYAL "POWR-KORD"

**There's a Royal "POWR-KORD" for every need:**

- RUBBER or VINYL
- BLACK or RED (rubber)
- RED or YELLOW (vinyl)
- HANDY LENGTHS — from 10' to 100'
- IN THESE TYPES and SIZES:  
#18 and #16 SJ — 2- and 3-conductor  
#18 thru #12 S — 2-conductor  
#14 and #12 S — 3-conductor  
#18 and #16 SJT — 2-conductor

**ROYAL**  
ELECTRIC  
an associate of

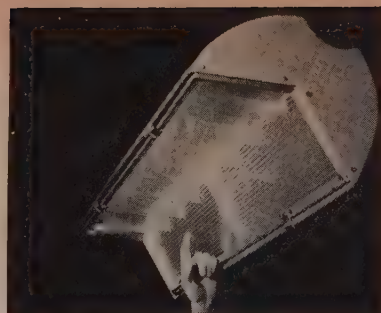
## ... the all-quality line of all-purpose heavy-duty extensions

Here's the kind of rugged construction that pays off on the job: MOLDED-ON caps and connectors, — built-in strain reliefs — Royal-quality cord — heavy brass blades and double-wipe contacts — locked-in-place molded construction . . . and FULLY UL LISTED!

Next time you're ordering electrical supplies from your wholesaler, be sure to include Royal "POWR-KORDS".

**ROYAL ELECTRIC CORPORATION**  
Pawtucket, Rhode Island

In Canada: Royal Electric Company (Quebec) Ltd.  
Pointe-Claire, Quebec



## Luminaire (11)

A new fluorescent luminaire, Type HUS-72, designed for use along ship canals. Unit uses both reflector and refractors to confine light to canal banks. Outer housing of unit, made from laminated fiber-glass, is noncorrosive and dent-proof. Refractor is made of clear acrylic plastic. Two 6-ft, 160-watt lamps are housed in unit with contoured, aluminum reflectors.

Westinghouse Lighting Div.,  
Edgewater Park, Cleveland, Ohio



## Switchgear (12)

A new line of high-voltage fused load interrupter metalclad switchgear rated as high as 44,500 amps fault-closing and 500-mva short-circuit interrupting at 14.4 kv has been introduced. Corresponding ratings at 4.16 kv are 60,000 amps fault-closing and 250-mva short-circuit interrupting. Closing on 44,500-amp faults is made possible by a new load interrupter with an integral quick-make, quick-break device for high-speed closing. Closing action is sequenced so that the circuit is made on separate arcing contacts before the load-carrying contacts close. Interrupting duty to 500 mva is provided by a new solid-material boric-acid power fuse. It is available in ratings from 4.8 kv through 14.4 kv. Generally applied as switching centers and service entrance equipment, switchgear is available in continuous ratings of 200, 400 and 600 amps, fused.

S&C Electric Co., 4435 Ravenswood Ave., Chicago 40, Ill.



# INTERRUPTS 75,000 AMPS

## MARK 75 CIRCUIT BREAKER

**High interrupting capacity  
in standard frame sizes**

- Mark 75\* breaker is ideal for use in network systems.
- Mark 75 breaker is UL approved.
- Mark 75 breaker is available at only a fraction of the cost of other high interrupting capacity breakers . . . and comes in the same sizes and is interchangeable with the standard line of Westinghouse AB breakers.
- Mark 75 breaker is available now in frame sizes HF, HK, HKL and HLM. Only from Westinghouse can you get the right breaker for every application.

For complete information on this new Westinghouse development, contact your nearby Westinghouse sales office or distributor, or write Westinghouse Electric Corporation, Standard Control Division, Beaver, Pennsylvania. J-30305

\*Trade-Mark

Westinghouse . . .

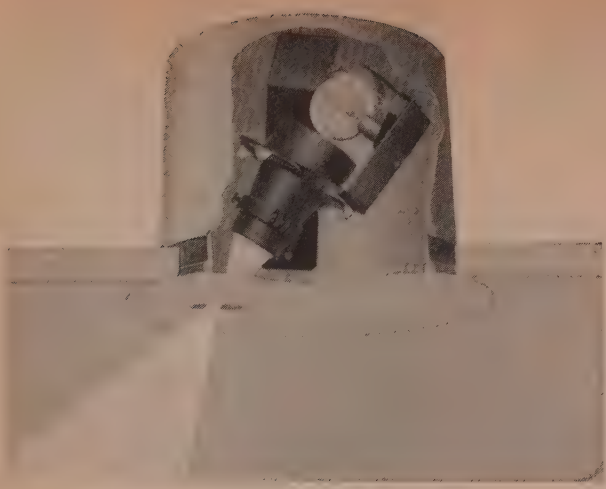
Pioneer, Developer and Leader of the Circuit Breaker Industry

**YOU CAN BE SURE...IF IT'S**

# Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL • DESI ARNAZ SHOWS"  
CBS TV, ALTERNATE FRIDAYS





## Pinhole Downlights with Designed Optics by Kliegl

**... the Great Name in Lighting!**

Designed optics . . . properly controlled accent and picture lighting from an inconspicuous light source. Kliegl Pinhole Downlights are equipped with adjustable four-way shutters and are fully focusable. They feature a precision, three lens, optical system for high efficiency illumination and sharp beam control without spill light.

Every feature of this outstanding Kliegl unit has been specifically designed to enhance and dramatize the natural beauty in a picture or other objets d'art.

*Plan to use Kliegl Pinhole Downlights in your next project. In the meantime, for complete information, write for our Architectural Lighting Catalog.*

lighting

**KLIEGL BROS.**

UNIVERSAL ELECTRIC STAGE LIGHTING CO., INC.

321 W. 50th ST., NEW YORK 19, N.Y.

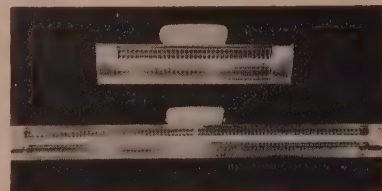
ORIGINATORS AND MANUFACTURERS OF KLIEGLIGHTS



### Lighting Fixture (13)

A new recessed type lighting fixture with a "plug-in" unitized electrical assembly which can be replaced at the ceiling by a tested spare. After removal a defective electrical unit is bench-serviced and becomes a tested spare. Known as the "Shallotroffer," fixture recesses into a 5½-in. plenum chamber. Series includes a choice of 11 diffuser types. During installation integral mounting brackets withdraw into housing as fixture is raised into position. Brackets then push outward to engage on supporting ceiling members.

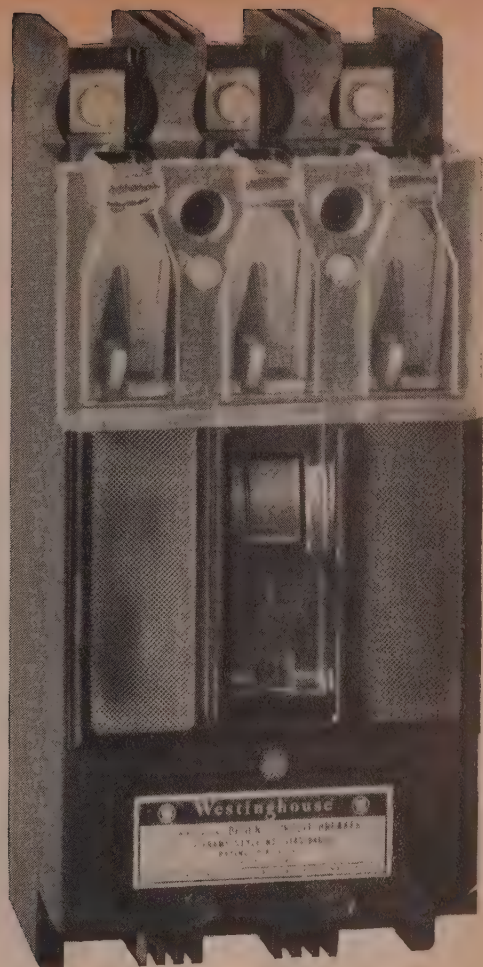
Globe Illuminating Co., 2121 South Main St., Los Angeles 7, Calif.



### Heaters (14)

Two new heaters have been added to this line of Infra-Safe infrared radiant heating units. They have 450 and 1500 wattages and each is designed for both domestic and industrial purposes and can be installed on either wall or ceiling. All parts are moisture resistant. Heart of unit is comprised of a quartz tube surrounding a resistor coil and backed by an infrared reflector. Covering face of heater is a decorative and protective grille. Model No. 30902, 450 watts, covers a 30 sq ft area while model No. 30903, 1500 watts, heats 90 sq ft. Width and height are 4½ in. and overall length is from 19½ in. to 44½ in.

Hanovia Lamp Division, Engelhard Industries, Inc., 100 Chestnut St., Newark, N. J.



# CONTACTS ARE VISIBLE!

## SAF-T-VUE CIRCUIT BREAKER

**You can see the  
contacts at a glance**

- Saf-T-Vue\* offers breaker convenience with maximum safety.
- Saf-T-Vue is suitable for use where plant safety codes require visible contacts.
- Saf-T-Vue is available in frame sizes E, EH, F, G, J, JK, K, JKL, KL and LM. Only from Westinghouse can you get the right breaker for every application.

For complete information on this new Westinghouse development, contact your nearby Westinghouse sales office or distributor, or write Westinghouse Electric Corporation, Standard Control Division, Beaver, Pennsylvania. J-30308

\*Trade-Mark

Westinghouse . . .

Pioneer, Developer and Leader of the Circuit Breaker Industry

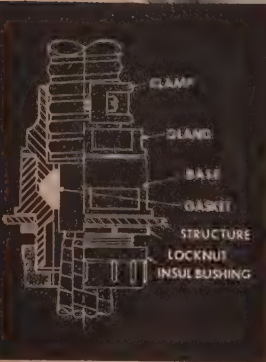
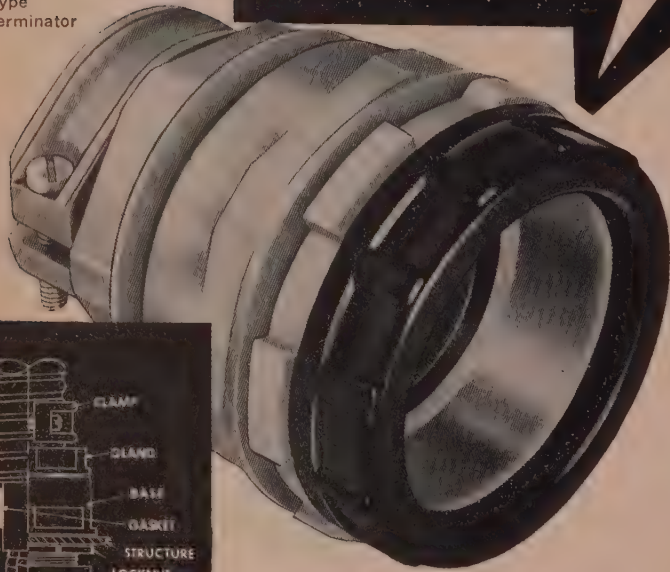
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CBS TV ALTERNATE FRIDAYS



PLM Type  
ACS Terminator



*Damp locations?*

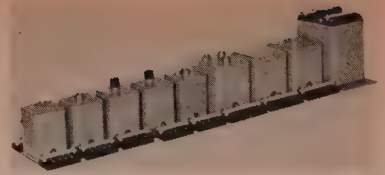
# There's a PLM fitting to fit the job!

Installing armored cable where conditions call for moisture-tight terminators? There's a PLM fitting to fit the job—as well as others to fit almost any other type of indoor or outdoor mounting requirement!

PLM terminators for armored cable, and PLM terminating and splicing kits for armored, non-metallic jacketed and lead-covered cable through 23 kv. can simplify and speed up any cable installation and repair. Get full information on these time and money saving PLM products. They are fully described in PLM 52-page catalog 301. Write for copy on your letterhead.

**PLM** TERMINATING AND  
SPlicing ACCESSORIES  
*Products, Inc*

3875 WEST 150th STREET • CLEVELAND 11, OHIO

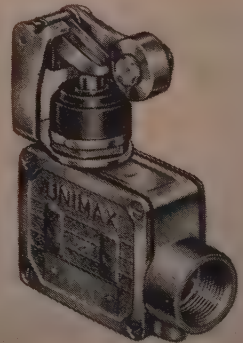


## Modules

(15)

A complete line of static regulator modules for industrial users. Originally developed for use on C-H's packaged dc drives and mill processing line control, these regulators are also available to panel builders, control assemblers and custom designers. Completely static, units are ideal for control of motor or generator fields, speed regulators, current regulators, time rate or current limit control. Line consists of adjustable time reference unit; power supply; reference regulator; 15-volt comparator; 30-volt comparator; power amplifier; cross-over unit; adjustable current limit unit; low level current amplifier; and 6-volt bias supply.

Cutler-Hammer, Inc., 228 North 12th St., Milwaukee, Wis.



## Switch

(16)

Unimax adjustable-roller-arm enclosed switch comprises a basic 2HB-5 single-pole, double-throw, precision snap-acting switch in a die-cast aluminum housing having a sealed overtravel plunger and an adjustable roller-lever actuator suitable for operation by either fast or slow cams or slide actuating devices. The actuator arm can be adjusted through 240° around its shaft, and actuator bracket can be rotated about plunger and locked in any of eight positions, 45° apart. Basic switch in unit is UL listed at 20 amps, 125/250/480 volts ac and can be furnished with hp ratings of ¾ hp 125 volts ac and 1½ hp 250 volts ac.

Unimax Switch Div., W. L. Maxson Corp., Ives Road, Wallingford, Conn.



# PREVENTS NUISANCE TRIPPING AMBIENT-COMPENSATING BREAKER

**No worry where extreme  
temperature changes exist**

- Ambient compensation prevents the breaker from derating the conductors.
- Ambient compensation provides insurance against current interrupting due to false high-temperature influences.
- Ambient-compensating breakers, exclusive with Westinghouse, are available in all frame sizes. Only from Westinghouse can you get the right breaker for every application.

For complete information on this new Westinghouse development, contact your nearby Westinghouse sales office or distributor, or write Westinghouse Electric Corporation, Standard Control Division, Beaver, Pennsylvania. J-30309

Westinghouse . . .

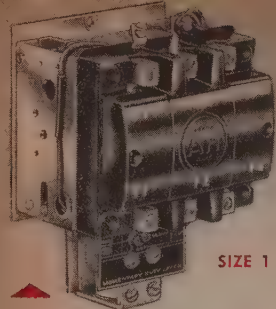
Pioneer, Developer and Leader of the Circuit Breaker Industry

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## Westinghouse

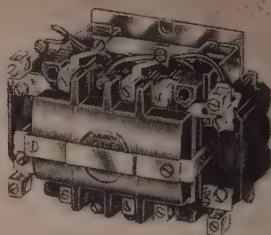
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CBS TV ALTERNATE FRIDAYS





MODEL 58  
"RA" STARTERS  
in SIZES 0 through 5

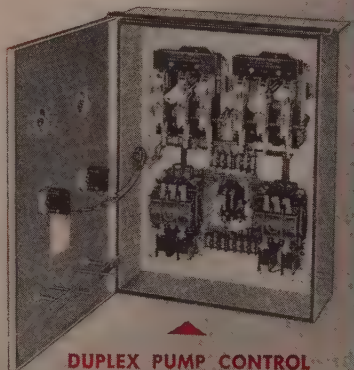
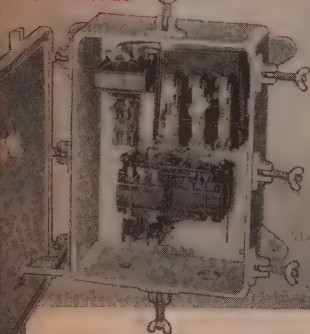
SIZE 1



MECHANICALLY HELD  
CONTACTORS  
in SIZES 0 through 5



FOOT SWITCHES  
LIGHT, MEDIUM and HEAVY  
DUTY TYPES



DUPLEX PUMP CONTROL

WEATHERPROOF AND  
EXPLOSIONPROOF  
ENCLOSURES

## NEW, IMPROVED MOTOR CONTROLS INTRODUCED by ARROW-HART for 1960

Pictured above are only a few of the many **NEW, IMPROVED** motor controls offered by Arrow-Hart during 1959.

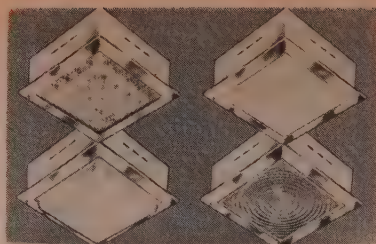
Arrow-Hart engages in *user and customer* research, as well as product research, to determine what advances in motor control design and construction are necessary to supply you with products that *meet present needs and anticipate future requirements*.

Long experience . . . look-to-the-future research . . . an unmatched reputation for quality earned through 70 years of service to the electrical industry . . . are sound reasons for relying on **ARROW-HART**, for specifying — buying — using — motor controls that bear the famous **ARROW-HART** trade-mark. Write for details on the new products pictured above to The Arrow-Hart & Hegeman Electric Co., Dept. ECM, 103 Hawthorn St., Hartford 6, Conn.

**ARROW AH HART**

*Quality since 1890*

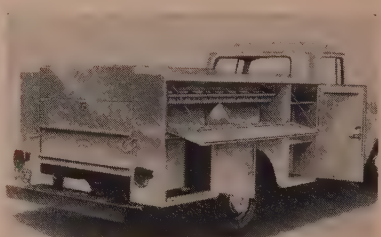
MOTOR CONTROLS • ENCLOSED SWITCHES  
APPLIANCE SWITCHES • WIRING DEVICES



Lighting Fixture (17)

Minute Mount has designed a new series of recessed lighting fixtures with luxury lenses and diffusers for the home. Series offers a selection of Fresnel lens, drop opal or satin-frosted bent glass, or standard flat glass diffuser. Air vents on all sides of recessed box provide ventilation.

*Progress Manufacturing Company, Inc., Philadelphia 34, Pa.*



Truck Body (18)

A new service body design, known as the "C" series with increased capacity. They are available in  $\frac{3}{4}$ - and  $1\frac{1}{2}$ -ton, with optional sliding roof, ladder racks, step-plate rear bumpers. Lower rear side compartments have been made considerably deeper. Long horizontal compartment is retained as is the full-length front vertical compartment.

*Stahl Metal Products, Inc., Cleveland, Ohio*

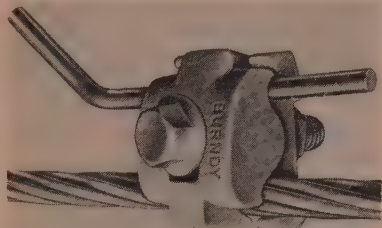
Meter Entrance (19)

New Hi-Liner Series UMB-200 pole-mounted meter entrance cabinet provides a 200-amp circuit breaker entrance service for use with underground secondary systems. Cabinet contains a 200-amp meter socket, 200-amp circuit breakers with overcurrent protection, a secondary wiring trough and terminal strip. Circuit breakers provide the main disconnect at the service pole to conform to the requirements of those areas where disconnects must be used when going to 200 amps and above. An extra 30-amp breaker may be added to the 200-amp main breakers for water heater or pump service. Smaller breaker may be controlled



independently for non-interrupting service when servicing other electric circuits. The UMB-200 entrance is housed in a heavy gauge NEMA-3 class enclosure. Cabinet measures 6 in. deep by 11 in. wide by 26 in. high. Circuit breakers used in the entrance are I-T-E, Type ET, 2-pole industrial class breakers with thermal time delay overload, and instantaneous magnetic trip short circuit protection. IC rating is 5000 amps at 240 volts.

Hi Products Division, General Electronic Control Inc., 7700 Wentworth Ave. So., Minneapolis 23, Minn.



#### Clamps (20)

Aluminum parallel groove clamps with interlocking fingers. The new connectors, designated UCG, accommodate copper, aluminum, and ACSR from No. 8 through 1/0. For high conductivity, contact surfaces are etched and coated with oxide-inhibiting "Penetrox A" joint compound.

Burndy Corporation, Norwalk, Conn.

#### Current-Limiting Fuses (21)

A new line of totally-enclosed, sand-filled current limiting fuses, Type FM, in ratings of 2400 to 4800 volts for use in high voltage motor controllers. Fuse consists of silver elements surrounded by dry inorganic sand all enclosed in a glass polyester base insulating tube. Fuse is connected into circuit by means of silver-plated copper ferrules on each end of tube. Silver elements are internally connected to ferrules which are completely silver-plated to maintain low resistance in its supports when fuse is mounted. A mechanical type indicator projects from lower end of fuse when its elements melt. Indicator is operated by a mechanism that is separate from elements and releases indicator only after fuse has blown.

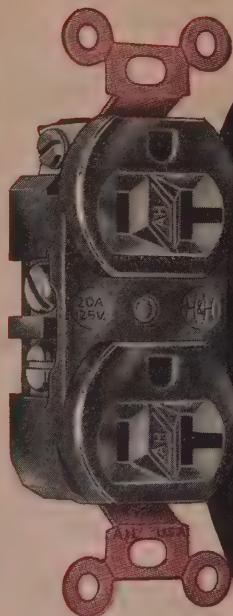
Allis - Chalmers Manufacturing Co., Milwaukee 1, Wis.

# ARROW



# HART

## NEW



RECEPTACLE  
5722

## 20 AMP GROUNDING DEVICES by

### ARROW-HART



3-WIRE  
2-WIRE  
20 AMPS  
125 VOLTS

GROUNDING CAPS and  
RECEPTACLES



CAP  
5786

## IMPORTANT TO YOU UNDER THE NEW CODE REVISIONS

The 1959 revisions of the National Electrical Code extend grounding requirements to many additional industrial and commercial installations, including: heavy-duty portable tools; scrubbers and similar maintenance equipment; business machines; and all receptacles in cellars, garages and open docks, etc. As a result, these new 20 Amp Grounding Caps and Receptacles will be "must" items on practically all your jobs.

Also available in weatherproof type with and without padlock, these Duplex Receptacles feature 2-circuit break-off fins that allow optional wiring as two electrically separate outlets. Caps are available in rubber and armor-over-rubber types.

Grounding devices are a "must" for electrical protection—and giving your customers the latest and finest available in grounding devices is a "must" in building your business and your profits. So write today for complete information.

Dept. ECM, The Arrow-Hart & Hegeman Electric Co. 103 Hawthorn Street, Hartford 6, Connecticut.

## ARROW HART

*Quality since 1890*

WIRING DEVICES • APPLIANCE SWITCHES  
ENCLOSED SWITCHES • MOTOR CONTROLS



**To save time ...  
Every Tool Box Needs  
a compact, easy-to-carry**

# RIGGID®

## Drop Head Threader Set

Snap a die head in the ratchet ring ...cut your thread! It's as simple as that with a RIGGID drop head threader. Heads can't fall out... dies reverse quickly for close-to-wall threading. Finest quality RIGGID long wearing dies. Conduit dies available.

**Call Your Supply House!**



### Hand Carrier Free With All Sets Except No. 12-R

(Order in sets or any combination)



#### Exposed Ratchet Type

For pipe: 1/8" to 1" — 00-R; 1/8" to 1 1/4" — 111-R;  
1/4" to 2" — 12-R

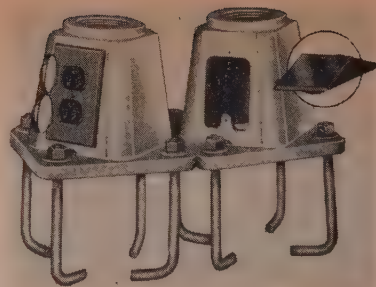
For bolts: 1/4" to 1" — 00-RB

#### Enclosed Ratchet Type

For pipe: 1/8" to 1" — 0-R; 1/8" to 1 1/4" — 11-R

# RIGGID®

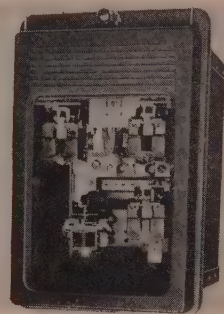
The Ridge Tool Company, Elyria, Ohio, U.S.A.



### Aluminum Pole Base (22)

A new aluminum alloy pole base for outdoor lighting jobs. Bases are threaded for 2-, 2 1/2- and 3-in. pipe size. Anchor bolts and mounting template are included. An easily accessible grounding screw is standard with all models.

*Moldcast Manufacturing Co., 236 South St., Newark 5, N. J.*



### Relay (23)

A new relay, type COM-5, is for complete motor protection from very light to heavy overloads. From minimum pickup to 175% of tap value setting, an alarm is sounded and an operator is allowed five to ten minutes to remove the trouble. With medium overloads, it gives normal time delay tripping protection. Relay provides for instantaneous tripping on heavy fault current.

*Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa.*

### Silicone Varnish (24)

An all-new Class H silicone dipping and impregnating varnish has been announced. Designated Dow Corning 980 varnish, it cures in six hours at 150C. It resists moisture and is unaffected by many corrosive atmospheres. New varnish will make it possible for original equipment manufacturers and service shops to produce Class H units on production equipment designed for Class A and Class B equipment.

*Dow Corning Corporation, Midland, Mich.*

## Wiring Devices

(25)

A new line of wiring devices, called "Chem Marine," is designed to resist corrosion, oils, greases, and most acids. "Insulprene" and "Melamine" are used as insulating materials. Monel metal and heavy nickel-plated brass are used for current-carrying contacts. "Chem Marine" is built around "Twist-Lock" and grounding lines. "Twist-Lock" is represented by 2- and 3-wire caps, connectors and receptacles. Caps and connectors are offered with protective "Seal-Tite" rubber covers. The 3-wire, 15-amp, 125-volt grounding devices are included for use with portable electrical tools and equipment. A new combination unit—weather proof "Insulprene" plate and "Press-switch" answers the need for an outdoor switch that is operative while completely enclosed. The flush-mounted "Insulprene" plate is a weatherproof covering that fits both FS and standard boxes.

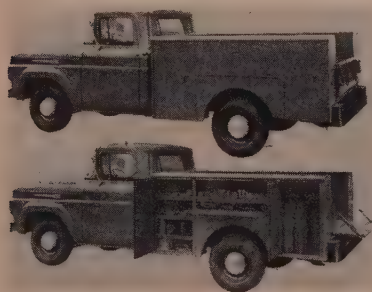
Harvey Hubbell, Inc., Bridgeport 2, Conn.

## Wall Plates

(26)

A new line of narrow metal wall plates, called "Slim-Line," are supplied in four widths, 1½, 1¾, 2 and 2½ in. with a full bevel. All sizes are in standard wall plate length of 4½ in.

Mulberry Metal Products, Inc., Stanley Terrace, Union, N. J.



## Truck Bodies

(27)

A new line of job-planned utility bodies has been redesigned for the 1960 Ford chassis. The body has been lowered 2 in. Lower body provides unobstructed vision from rear window of cab. They are offered in ½, ¾ and 1 ton models. They feature adjustable and removable dividers and removable shelves in weather-tight storage compartments.

Reading Body Works, Inc., Reading, Pa.

**RIGID** Thread Cutting Oils are available in convenient (4 ounce Nu-Clear only), 1 quart, 1 gallon, (2 gallon Nu-Clear only), 5 gallon, 30 gallon and 55 gallon containers.

Same dies, same pipe, but **RIGID** Thread Cutting Oil made the difference!

Tests prove **RIGID**  
Thread Cutting Oil gives you better threads  
faster...lengthens die life, too!

Recently a distributor in Atlanta, Georgia investigated a complaint of "bad pipe". Test threads were made in all sizes. Torn threads resulted. Then **RIGID** Nu-Clear Thread Cutting Oil was substituted for the oil being used. Perfect threads were obtained every time.

Here, then, is dramatic proof that you need a special purpose thread cutting oil... an oil that *cools, speeds metal removal, produces a smooth finish, and prevents chips from welding to your dies.*

No oil—in its pure state—will perform all these functions. That's why **RIGID** Thread Cutting Oils are an exclusive, exactly formulated combination of oils, blended for easier, faster threading... longer die life. What's more, these special-purpose **RIGID** oils are completely antiseptic... no danger of irritation or infection.

Make sure of good threads every time. Order **RIGID** Thread Cutting Oil from your Supply House today. *Tops for all metal cutting... you'll want an extra supply for your lathe, drill press and other metal cutting equipment.*

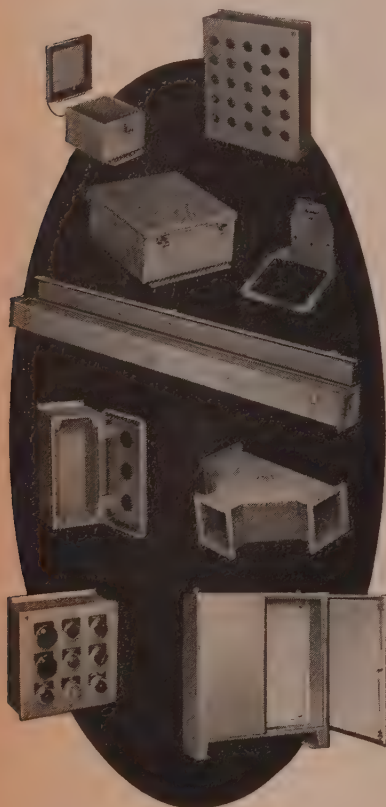
**RIGID**

The Ridge Tool Company, Elyria, Ohio, U.S.A.





For liquid-tight wiring enclosures built to JIC and Nema standards...



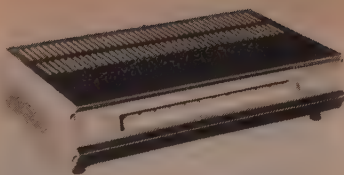
It pays to figure on

## KEYSTONE

Keystone offers a complete line of JIC and Nema enclosures to give positive, sealed protection against dust, dirt, oil, water and coolants! All types and sizes of liquid-tight wireways, fittings, troughs, boxes and cabinets—to meet your exact needs.



**KEYSTONE**  
MANUFACTURING CO.  
23330 Sherwood Ave. • Warren, Mich.



### Intercom System (28)

New all-transistor intercommunication system called the Chief. It is proportioned like a book, lies flat on the desk and is less than 3 in. high. New standard features include a monitoring signal which visually indicates to a non-private station that it is being monitored; an incoming call chime; an external relay control for use in high noise level areas; and reciprocal power supply for use where no electrical outlet is available. Private or non-private masters and staffs and busy signals which visually indicate when a given station is in use, now are standard equipment in the series.

Talk-A-Phone Co., 1 No. LaSalle St., Chicago 2, Ill.



### Power Saw (29)

New and improved "Iron Mike" portable power saw. It can be operated with any motor from  $\frac{1}{2}$  hp and up, 1725 rpm. It has a new improved base and carrying handle. Saw weighs 16 lbs without motor. It makes uniform straight cuts through everything up to and including  $3\frac{1}{2}$ -in. steel shafting.

Arco Mfg. Co., Grand Forks, N. D.

### Outdoor Lighting (30)

Residential yard light, called Lawn-Glo luminaires, provide a large area of illumination for lighting drives, entrances, swimming pools and recreational areas. Furnished with or without an integral photoelectric control, they are particularly suited for security lighting. Fixtures may be used with incandescent lamps rated through 150

watts. They are available in natural aluminum, black or pastel colors, with or without 7-ft metal or redwood standards. A utility outlet is built into slipfitter base for plugging in other electrical appliances.

Line Material Industries, McGraw-Edison Co., Milwaukee 1, Wis.

### Conversion Unit (31)

A new silicon rectifier conversion unit is for use in high voltage dc power supplies on electrostatic precipitators that collect fly-ash and dust particles in industrial plants and electric utility generating stations. Units consist of silicon rectifier diodes which are immersed in oil and enclosed in an insulating cylinder. Conversion units are available for use with rectifier transformers rated up to 75,000 volts rms, and up to 45 kva in full wave bridge rectifier circuits.

General Electric Co., Schenectady 5, N. Y.

### Boxes (32)

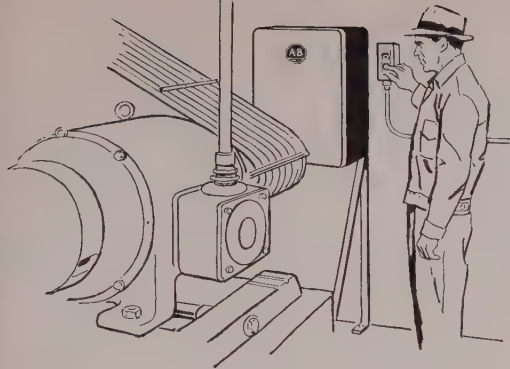
An improved line of Type A-NEMA 1 hinged cover surface cutout boxes are designed as wiring enclosures for installations where a box for surface mounting is needed to serve as a junction, service, switch, panel or cutout box. They are primarily intended for general purpose indoor applications to protect against dust and light, indirect splashing. All standard stock boxes come supplied with a corrosion-resistant baked-on gray enamel finish and are available with or without standard knockouts, as desired.

Keystone Manufacturing Co., 23328 Sherwood Road, Warren, Mich.

### Heater (33)

An infrared radiant heater designed especially for a wide-range of industrial applications is known as the Infra-Safe radiant industrial heater. The 46-in. long unit can be installed singly or several may be grouped on the wall or suspended from ceiling or fixed conduits. Unit can be controlled manually or, if desired, by an automatic on-off cycle. Thermostats may also be utilized to maintain specified heat requirements. Unit is rated 1500 watts ac-dc.

Hanovia Lamp Division, Engelhard Industries, Inc., 100 Chestnut St., Newark, N. J.



# WHEN REDUCED VOLTAGE STARTING IS A **MUST**

Only Allen-Bradley  
can provide all the answers

The Allen-Bradley line of reduced voltage starters makes possible a selection of the best starter, not only to meet the power company's requirements but also to provide the best starting conditions for the motor and the "load" that it drives.

The simple solenoid contactors in A-B reduced voltage starters have only ONE moving part—assuring millions of trouble free operations. And their double break, silver alloy contacts never need costly maintenance. Accurate, reliable overload relays protect motors against burnouts. Write for Publication 6088.

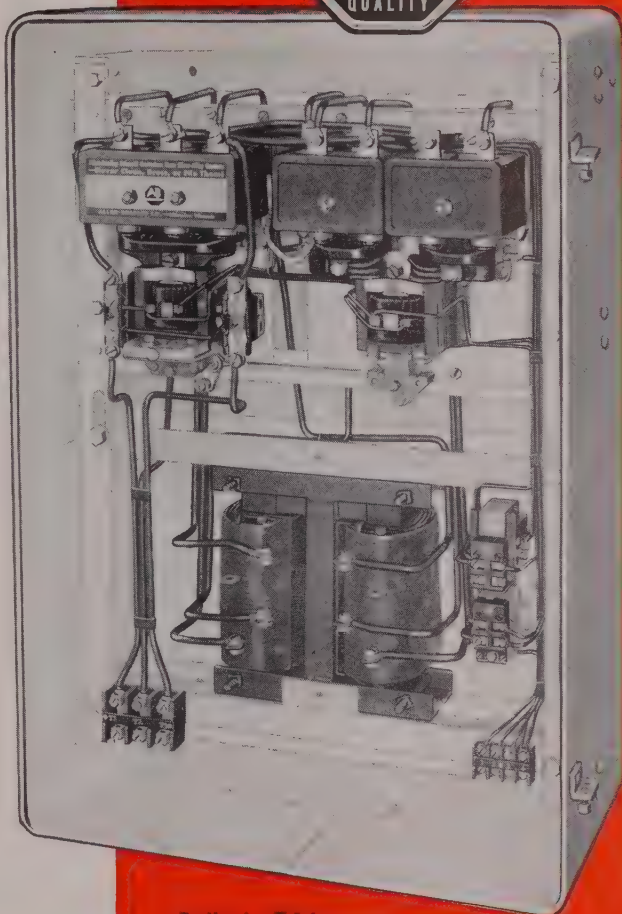
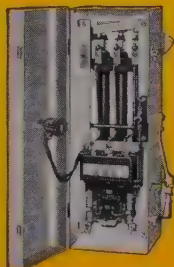


## Bulletin 740

Graphite disc resistors are automatically inserted in series with the squirrel cage motor at starting, and they are automatically cut out after a pre-determined time. Turning a single screw on the starter frame adjusts the compression resistors exactly to motor and load conditions for velvet smooth acceleration. Ratings to 200 hp, 220-440-550 v.

## Bulletin 640

Where remote control is not needed, these graphite compression disc resistor starters provide stepless acceleration of squirrel cage motors. Operated by hand lever, the smooth starting of the motor is under the control of the operator. No-voltage and dependable overload protection is provided. Ratings to 200 hp, 220-440-550 v.



## Bulletin 746

Automatic reduced voltage starter for squirrel cage motors that should not be started on full line voltage. It employs autotransformer connected in open delta to reduce line voltage during starting. Adjustable timing relay controls starting period. Taps are provided on the autotransformer to adjust the starting voltage applied to the motor. Ratings to 300 hp, 220 v; 600 hp, 440-550 v.

# ALLEN- BRADLEY

Member of NEMA

## Quality Motor Control

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.  
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.





# Positive Protection Against Phase Failure and Phase Reversal



*Here is your answer!*

The Allen-Bradley Bulletin 812 Type F, Type R, and Type RF relays provide positive protection against the hazards to men, motors, and driven machinery, resulting from phase failure and/or phase reversals.

The Bulletin 812 Style F phase failure relay employs a unique static sensing network that responds to all open phase conditions on a motor branch circuit and immediately removes the motor from the line . . . irrespective of the load on the motor (including no load), or the circuit arrangement. This relay even responds to hard-to-detect primary failures on a wye-delta transformer with ungrounded neutral. Furthermore, the five-cycle response prevents nuisance "drop-outs" from transient fluctuations.

The Bulletin 812 Style R phase reversal relay disconnects the motor from the line—whether it is running or not—when a phase reversal occurs anywhere in the system on the line side of the relay. Thus, it can be employed for a single motor, a group of motors, or an entire power system. In addition, the phase reversal relay prevents the motor from starting should phase failure occur while at a standstill—a vital feature for elevator applications.

The Bulletin 812 Style RF relay combines the elements of Style R and Style F relays for protection against both phase failure and phase reversal. All Bulletin 812 relays are inherently "fail safe." Send for complete information.

Allen-Bradley Co., 1316 S. Second St.  
Milwaukee 4, Wis.

In Canada: Allen-Bradley Canada Ltd.  
Galt, Ont.

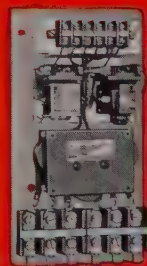
**ALLEN-BRADLEY**  
QUALITY  
**MOTOR CONTROL**



Bulletin 812, Style F  
for Phase Failure  
and Phase Reversal

## INDIVIDUAL RELAY UNITS AVAILABLE

### For Phase Failure



Style F covers full load currents from 1.5 to 300 amp in 4 sizes. Coils for up to 600 v, 60 cycles.

### For Phase Reversal



Style R made with coils for 110, 208/220, 440, 550 v for either 50 or 60 cycle operation.



### Bathroom Fan (34)

A new bathroom fan for ceiling or sidewall installation has been added to this line. Model BF2C is for remodelling and new construction. It fits between standard 2 by 4 wall studs, takes a 3-in. round duct, and comes complete with hanger bars for installation. Housing dimensions are 8 in. wide by 10½ in. long by 4 in. deep.

*Berns Air King Corp., 3050 North Rockwell St., Chicago 18, Ill.*

### Limit Switches (35)

Two new maintained-contact yoke-actuator limit switches, each utilizing a new type actuator, have been added to the "LS" and "200 LS" series. When moved from either extreme position toward the other, the actuator causes the internal switching unit to transfer and maintain circuit. Actuator heads may be mounted in four positions, 90° apart. Yoke actuator may be rotated 360°, locking in any position. Switches in both series have electrical capacity of 10 amps, 120, 240 and 480 volts, ac.

*Micro Switch, Division of Minneapolis-Honeywell Regulator Co., Freeport, Ill.*

### Emergency AC Power (36)

Five standard models designed to provide emergency ac power automatically and instantly in event of power line failure. They are available with 60-cycle, 110-volt outputs from 40 to 150 watts. Special voltages and cycle outputs are also available. Emergency lighting is also supplied automatically upon power failure. Standard models will illuminate an area approximately 70 by 90 ft with a directional type lamp. A special replaceable-cell, high-amperage industrial storage battery is kept fully charged automatically.

*Sentry-Lite Division, Scranton Cellomatic Battery Corp., Archbald, Pa.*

**CAN YOU COUNT THE  
CONVENIENCE OUTLETS  
IN THIS LABORATORY?**



Dunham Laboratory, Yale University

**ONE Free**

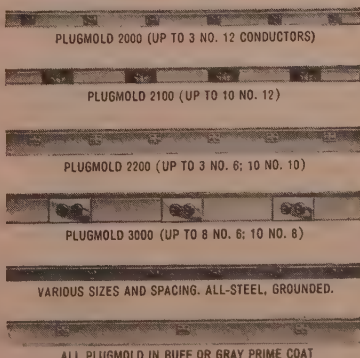
**WIREMOLD  
SCREWDRIVER**



to every contractor or engineer who sends in his guesstimate of the number of outlets in the absolutely unretouched photo at left. (Two screwdrivers for each correct answer! Nobody ever loses with Wiremold!) PLUS A CERTIFICATE THAT PROVES YOU ARE A GENUINE ELECTRICAL EAGLE-EYE!

**YOU HAVE TO LOOK TO  
FIND THEM IN A PICTURE  
BUT THEY'RE ALWAYS  
SO HANDY IN PLUGMOLD**

That's why contractors like PLUGMOLD. It's so easy to install; makes every job look so good. The customer is always right — always satisfied — with PLUGMOLD.



**and remember: PLUGMOLD GIVES  
MORE OUTLETS FOR LESS MONEY**

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THE WIREMOLD COMPANY • HARTFORD 10, CONN.

WIREMOLD • HARTFORD 10, CONN.

My guess is that there are \_\_\_\_\_ outlets.

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

EO-2





## QUALITY SHOWS THRU . . . on SKIN-PAK CARDS

- Split Bolt Connectors
- Service Entrance Connectors
- Solderless Terminal Lugs

Here's the newest way to buy connectors and lugs from your electrical wholesaler . . . on Skin-Pak Cards where the products are held under a tough, brilliant layer of plastic that keeps them clean, handy and protected until ready for use. Why buy a handful or a boxful to roll around in the bin or tool kit, get scarred up and dirty when you can buy convenient quantities in strips, keep them handy and protected until they're ready to install on the job? Just give them a try. You'll like the ease of handling and carrying. You'll like the visual inventory control to warn you when you need more. You'll like the physical as well as the electrical cleanliness so vital to good, safe connections. And you will save money by eliminating thread damage, loss and misplacement. Try Porcelain Products lugs and connectors on Skin-Pak Cards the next time you buy.

### THESE ARE THE CONNECTORS PRESENTLY AVAILABLE ON SKIN-PAK CARDS

| ITEM                             | Quantity<br>on Card | Quantity<br>per Strip | Conventional<br>Carton Quantity |
|----------------------------------|---------------------|-----------------------|---------------------------------|
| 10-C Split Bolt Connector        | 50                  | 10                    | 100                             |
| 8-C Split Bolt Connector         | 50                  | 10                    | 100                             |
| 6-C Split Bolt Connector         | 25                  | 5                     | 100                             |
| 4-C Split Bolt Connector         | 20                  | 4                     | 100                             |
| SL-8 Solderless Terminal Lug     | 50                  | 10                    | 100                             |
| SL-4 Solderless Terminal Lug     | 50                  | 10                    | 100                             |
| SL-0 Solderless Terminal Lug     | 20                  | 4                     | 100                             |
| 12-SE Service Entrance Connector | 100                 | 20                    | 100                             |
| 10-SE Service Entrance Connector | 100                 | 20                    | 100                             |
| 6-SE Service Entrance Connector  | 50                  | 10                    | 100                             |

**PORCELAIN PRODUCTS CO.**  
225 N. PATTERSON ST., CAREY, OHIO



### Transformers (37)

A new 333-kva distribution transformer suitable for pole or platform installation. It is lighter and more compact than the station-type unit it replaces. Average impedance is 2.5 to 3%. It is an addition to its "Featherweight Pole Star Transformers," which now includes single-phase ratings of 167, 250 and 333 kva, 15 kv and below.

*Pennsylvania Transformer Division, McGraw-Edison Co., Canonsburg, Pa.*

### Controller (38)

New type PC Chromatrol electronic controller gives temperature control within 1° F up to 600° F. Stainless steel sensing element is a small bullet-probe 1 in. long and 1/4 in. in diameter. The pre-aged thermistor probe may be located in platens, in air ducts and in immersion wells up to 100 ft away from amplifier-relay cabinet. Loads up to 10 kw can be controlled directly without a separate magnetic contactor. May be used on 120, 208 or 240 volts, 60 cycles. Scale covers dual-range from 25° to 225° F or 200° to 600° F. Dial-plate control is removable from amplifier-relay for remote location up to 30 ft away. Controls may be at one location.

*Edwin L. Wiegand Company, 7500 Thomas Blvd., Pittsburgh 8, Pa.*

### Ventilating Hoods (39)

Two new lines of ventilating hoods for ranges, called the "DeLuxe Champion" and "Challenger" styles, are designed for installation either in old or new homes. Both are pre-wired and have mitered corners. The "DeLuxe Champion" removes stale air, smoke, and odors with a high pressure centrifugal blower unit pulling through a washable filter. Blower is powered by a 2-speed motor. Air discharge is through rear or top. Illumination

is provided by incandescent lights recessed behind a light diffuser. Both lights and blower are controlled by front-mounted butterfly switches. The "Challenger" removes air through an electric motor and fan unit. It pulls air through a washable filter. With topair discharge, this line also has two incandescent light receptacles and front-mounted butterfly switches for both lights and fan. Both lines are available in standard 30, 36, 42 and 48-in. width sizes.

*Lau Blower Co., 2027 Home Ave., Dayton 7, Ohio*

#### Demand Limiter (40)

A new power demand limiter used to control the power demand during the warm-up period on electric heat jobs. It consists of an outdoor adjuster and a cabinet housing a proportional amplifier, which serves as a polarized relay, and a proportional motor operator connected by a drive chain to a percentage cycling timer. Wired in series with a zone warm-up thermostat, it cycles the electric heating equipment in an off-on manner until warm-up is accomplished. Only one limiter is required on each job, even though there may be several zones of night control, for it is possible to wire the limiter's switching circuit to the warm-up time clock so that it is switched out of the circuit as each separate zone switches to its day cycle.

*Barber-Colman Company, 1300 Rock St., Rockford, Ill.*



#### Transformers (41)

A new line of constant-wattage mercury-lamp transformers for low-temperature, indoor service. Units are designed for single-lamp and two-lamp operation of 400-watt H1, H25, and H33 lamps. Two-lamp and single-lamp units are available for 115, 208, 230, 277, 460 and 575 volts. Literature is available.

*Sola Electric Co., 4633 W. 16th St., Chicago 50, Ill.*

# BRONCO

*Certified* **66**  
NEOPRENE

PORTABLE ELECTRICAL CORD AND CABLE

has the **HIGHEST**  
**NEOPRENE**  
content in the  
industry



The protecting outer jacket on Bronco 66 Certified contains 67.32% Neoprene—highest in the industry! This is why your Bronco 66 cables last longer, have greater resistance to oil, ozone, sunlight, heat, flame, chemicals, and abrasion.



**BRONCO TAKES  
THE GUESSWORK  
OUT OF CABLE  
BUYING**

How do you know your type SO cord or type W, G & Control cable is the best that can be had?

Look For These Two Symbols of Certainty:

1. Branding—"Bronco 66 Certified—67.32% Neoprene" is molded\* into the jacket at two-foot intervals.
2. Each carton and reel carries a registered certification as to jacket contents signed by a professional engineer. When you find these guideposts, then you will know that you have the best.

\*U.S. PATENT #2867001



**WESTERN INSULATED WIRE CO.**  
LOS ANGELES 28, CALIFORNIA



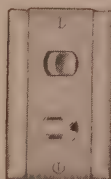
# **ROCKER-GLO**

**Performance,  
Convenience,  
Beauty...**

*for the West's  
Tallest Building*



2201 Rocker-Glo Switch



2211 Rocker-Glo Switch  
and 1432 3-wire  
Grounding Outlet



Beautiful, new 42-story Southland Center Building in Dallas proudly boasts new P&S Rocker-Glo switches in tenant offices and suites. Rocker-Glo in Despard combinations provides maximum electrical convenience in a single gang plate.

P&S Rocker-Glo switches are designed for use on tungsten filament and fluorescent loads at full current rating  $\phi$ . . can be activated by pressing, pushing, rocking or rolling.

For information, write Dept. ECM-26A

 **PASS & SEYMOUR, INC.**  
SYRACUSE 9, NEW YORK

60 E. 42nd St., New York 17, N.Y. 1440 N. Pulaski Rd., Chicago 51, Ill. In Canada: Renfrew Electric Co., Ltd., Toronto, Ontario

## **Switch**

(42)

A manual power switch that can be electrically tripped by practically any type of power from a remotely-located control or safety device. The new combination power switch-control interlock has an interrupting capacity of 2000 amps at 125 volts ac. It is available with either a current- or voltage-sensing coil. Bulletin 3201 is available.

Heinemann Electric Co., 352 Plum St., Trenton 2, N. J.

## **Masonry Drill**

(43)

A new portable masonry drill, Model K-600 "Roto-Kor," uses diamond core bits to cut clean holes at high speed through reinforced concrete and other masonry materials. Powered by a universal type electric motor it will drill holes up to 6½ in. in diameter at typical speeds of 1- to 2-in. deep per minute. Swivel feature permits drilling at any angle.

The Kor-It Company, Inc., 991 Richard Ave., Santa Clara, Calif.

## **Switch**

(44)

A new type ac indoor switch capable of interrupting load currents. Load interruption is accomplished by means of an auxiliary switch blade which, operating in conjunction with the main switch blade, breaks an arc drawn between two high arc resistant silver tungsten alloy contacts in polyester plates comprising the auxiliary switch housing. Porcelain inserts in the links insulate mechanism and shaft from switch poles.

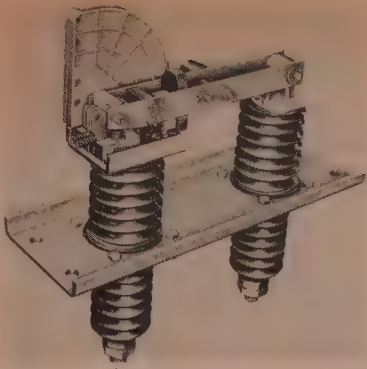
Electrical Engineers Equipment Co., 1502 N. 25th Ave., Melrose Park, Ill.

## **Pedestals**

(45)

Fusible power pedestals are designed primarily for use with Transclosures and pad-mount transformers in underground distribution systems. They facilitate above-ground connection of buried secondary services and mains. They accommodate eight 2/0 service conductors, two 4/0 secondary mains, and five 2/0 neutral conductors. Terminals accommodate cartridge-type fuses rated through 200 amps. Fibre conduit risers can be used to protect underground conductors.

Line Material Industries, McGraw-Edison Co., Milwaukee 1, Wis.



#### Interrupter Switch (46)

A new, modified type HPL-C interrupter switch for high fault closing requirements up to 40,000 amps. Design features include new spring-loaded, heavy-duty, self-aligning silver-plated stationary main contact fingers; heavy, silver-tungsten tipped, hard drawn electrolytic copper blades; heavy, silver-tungsten tipped, moving and stationary arcing tips; special blade guide; and heavy steel base. Rating is listed as 600 amps continuous.

*Greensburg Division of I-T-E Circuit Breaker Co., Greensburg, Pa.*

#### Portable Power Supply (47)

A new Zeus electric power supply unit, model GW-300, offers 3000 watts of output power. It features a permanent magnet alternator, which is connected directly to a gasoline engine and delivers a full power rating for long periods of continuous running. Other features include: recoil or electric start; non-integral fuel tank and air-cooled operation. Size is 19 in. high by 16 in. wide by 21 in. long.

*Pesco Products Division, Borg-Warner Corp., 3310 Vanowen St., Burbank, Calif.*

#### Motor-Load Indicator (48)

A new motor-load indicator, C-371, is for use on either single- or 3-phase, 50- or 60-cycle induction motors. It is designed for use with a 5-amp current transformer. The panel instrument measures the useful or working component of load current. Meter is calibrated for 190-280 volts, or for 350-550 volts. Two accessible resistor links permit operation of 190-280 volts. Removal of resistor links increases meter voltage range to 350-550 volts. Indicator is housed in a flush-mounted case.

*Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa.*



# SUPER AC

For  
Dependability  
Beyond a Doubt

*20AC1 Super  
AC Switches*



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EGGERS & HIGGINS  
ARCHITECTS

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CONTRACTORS, INC.  
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RENTING AND  
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Quality throughout is the keynote in the lovely new Canada House, 680 Fifth Avenue, New York City. That's why P&S 20AC1 AC switches have been specified.

P&S 20AC1 heavy duty AC switches have extra-heavy silver alloy contacts mounted at nodal point—for long life.

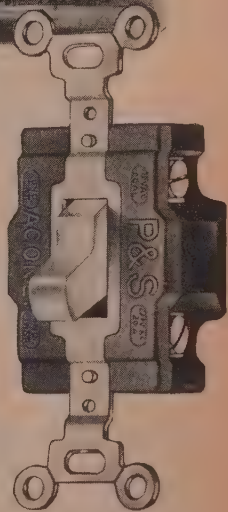
P&S Super AC switches can be used at full-rated capacity for tungsten filament lamp loads and fluorescent installations.

For information, write Dept. ECM-26B



**PASS & SEYMOUR, INC.**  
**SYRACUSE 9, NEW YORK**

60 E. 42nd St., New York 17, N.Y. 1440 N. Pulaski Rd., Chicago 51, Ill. In Canada: Renfrew Electric Co., Ltd., Toronto, Ontario



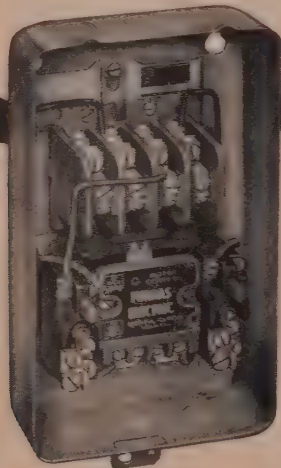
20AC1-1

**P**  
**PERFORMANCE  
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# Here's Why ... YOU GET Superior Performance FROM Furnas Controls

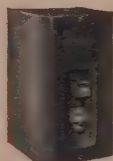
Furnas Electric Magnetic Starters feature advanced design to assure superior performance and longer life. Standardized design reduces inventory and allows a wider application with fewer components.



- Dual Voltage 110-220 or 220-440 Volt Coils reconnectable on the job. Magnet features just one moving part.
- Non-tracking Contact Block is impact resistant. Completely visible and front removable silver-cadmium oxide contacts.
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1067 McKee St., Batavia, Illinois

A75



**FURNAS ELECTRIC COMPANY**  
BATAVIA, ILLINOIS

Sales Representatives in All Principal Cities

## Catalogs & Bulletins

(49) FUSE CUTOUTS. Bulletin FC3 describes Type LMO cutouts rated 100 amps at 7.8, 15 and 27 kv with 20,000, 16,000, and 6000 amps IC. Line Material Industries.

(50) DISTRIBUTION EQUIPMENT for residential underground systems. Bulletin GEA-6981, 12 pages, covers installation and application of pad-mounted transformers and semi-buried transformer enclosures for pole-type units up to 167 kva. General Electric Co.

(51) CURRENT COLLECTORS for crane installations in locations where ash, grit, dust and weather are a constant problem. 4-page bulletin describes carbon collectors. Morganite Inc.

(52) FIRE ALARM SYSTEMS for schools, hospitals, industrial, and public buildings, including master coded and box coded systems, are covered in 36-page catalog. Standard Electric Time Co.

(53) LIGHTING FIXTURES featuring a plug-in unitized electrical assembly with 11 different bottom diffusing elements are described in 32-page Brochure B-2. Globe Illumination Co.

(54) MOTOR CONTROLS. Catalog 5900, 72 pages, provides condensed listing of general products including magnetic and manual starters, drum controllers and pressure switches. Furnas Electric Co.

(55) VENTILATING FANS. Design, installation and operational features of two models for ceiling and wall ventilation are described in Bulletin 271-L. Leigh Building Products.

(56) POWER RECTIFIERS which can be built to supply virtually any desired voltages and currents. 8-page Bulletin 6101-1A describes features of Unitron silicon rectifier. I-T-E Circuit Breaker Co.

(57) DRIP-PROOF MOTORS. Bulletin 196 illustrates five design features, explaining how these motors can replace totally enclosed models in many applications. Sterling Electric Motors, Inc.

(58) CONNECTORS. Bulletin PL-2 covers a flat, armored power connector with a pivotally mounted grounding blade which provides automatic ground connection when plugged into either 2- or 3-pole receptacles. A. P. M. Corp.

(94) **LIGHTING FIXTURES.** Catalog S-23 describes diecast aluminum wall bracket and ceiling lighting fixtures suitable for both indoor and outdoor installations. Prescolite Mfg. Corp.

(60) **INSULATION.** 4-page Bulletin 33 gives complete specifications of ten popular slit plastic films, papers, and combinations for electrical applications. Bulletin 32 includes cross-referenced index of complete line of fabricated electrical insulation. Insulation Manufacturers Corp.

(61) **LIGHTING UNITS** described in Catalog HO-2 include lights designed for hospital, hotel, and dormitory use. Prescolite Mfg. Corp.

(62) **ENCLOSURES** for housing distribution equipment at ground level. Bulletin CM1 covers design, application and specifications of Trans-closures for units rated 2.4 to 14.4 kvc. Line Material Industries.

(63) **ELECTRIC HEATERS** for melting soft metals. Bulletin PD106 describes cast-iron immersion heaters for operation up to 950F. Edwin L. Wiegand Co.

(64) **POWER DRIVES.** Revised Catalog 258, 68 pages, includes prices and dimensions, of power drives, motors, speed reducers and other units. Sterling Electric Motors.

(65) **RECESSED LIGHTING.** New 24-page catalog describes basic square, round and rectangular housings and trims plus new pendant and surface ellipses, pendant spheres, wall and ceiling brackets, projector spotlight and adjustable downlite. Halo Lighting Products, Inc.

(66) **ELECTRIC PLANTS.** New 12-page folder E344 illustrates complete line in sizes from 500 watts to 100 kw. Kohler Co.

(67) **EMERGENCY LIGHTING** equipment for automatic operation in case of interruption of regular power supply. 8-page Catalog LW-1 gives specifications and prices of all models. Electric Cord Co.

(68) **TRANSFORMERS.** Bulletin DT2 covers overhead-type conventional distribution transformers with single-phase ratings of 2.4 through 67 kv, 5 through 500 kva. Line Material Industries.

(69) **SAFETY INDICATOR.** Bulletin RG-21 describes Roto-Guard, mechanism designed to convert rotary motion into an electrical signal for energizing an alarm system or operating control switches for the protection of machinery. Bin-Dicator Co.



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No more fumbling in the dark . . . no more dirty walls from "switch-groping." Instead, a tiny, built-into-the-handle neon lamp that always remains bright, lasts a lifetime, and costs but a few cents a year to operate! This switch is sturdy, easy-to-install, with no moving parts to wear out, no springs to snap. Ideal wherever silence is essential . . . now popularly priced for every installation.

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# SAVE SPACE

## WITH NEW GENERAL ELECTRIC SAFETY SWITCHES

Lugs for either copper or aluminum wire (60 to 600 amp.).

Bottom-hinged and front-operated for close ganging.

Visible blades are spring-reinforced to assure full, firm contact; minimum joints in current path; silver-plated copper parts; no fiber linkages in mechanism.

Clear ON-OFF indication from over 100 feet. Ratings plainly shown on permanent metal nameplate.

HEAVY DUTY ▲

▼ LIGHT DUTY

Safety phase barriers guard against accidental contact with live parts.

General Electric's new safety switches bring you important savings in space, longer service life, maximum safety and more economical installation. And Heavy Duty (Type A) switches sell at Normal Duty (Type C) price levels. Write for Bulletin CPD-74. See your nearest G-E distributor for a demonstration.

# GENERAL ELECTRIC

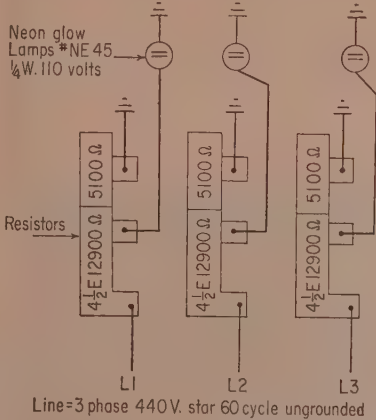
Circuit Protective Devices Dept., Plainville, Conn.

# Reader's Quiz

QUESTIONS from readers on problems of industrial equipment, installations, maintenance and repairs. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay \$5.00.

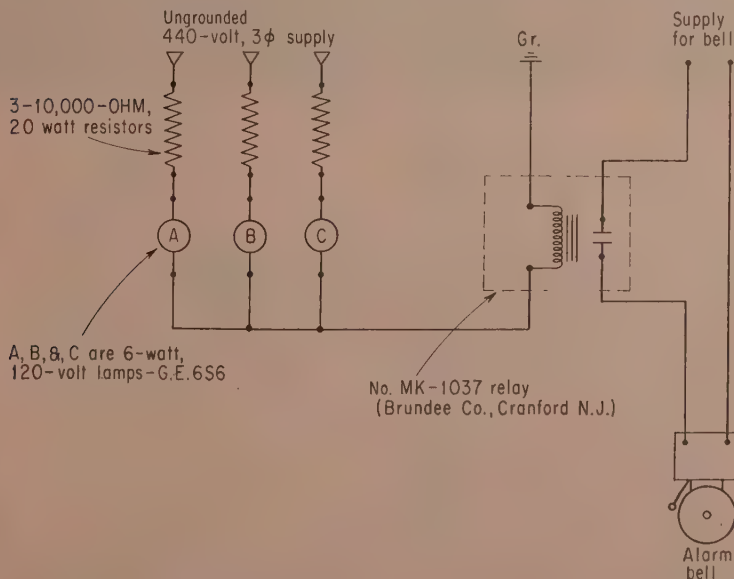
## Audio Ground Detector

**QUESTION F37**—Could anyone help me out in designing a circuit

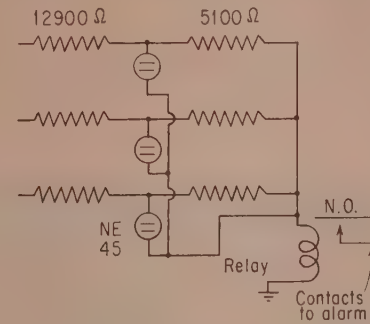


that would enable me to install an audio signal on this ground detector.—S.P.M.

**ANSWER TO F37**—The following sketch gives the devices and connections that will solve S.P.M.'s problem. Notice that the lamps and resistors are different from the sketch in the question. Lamps A, B, and C are 6-watt, 120-volt and are connected in series with 10,000-ohm, 20-watt resistors to each phase of the 440-volt system. Alarm bell rings with a fault on any phase.—W.J.B.



**ANSWER TO F37**—Normally, relay coil current will be practically zero; with one leg of system accidentally grounded the unbalance



current will be approximately 0.050 amps. A relay should be chosen which will carry this current but which will close at 0.025 amps, ac.—L.G.B.

## Cleaning Motors

**QUESTION E37**—In cleaning electric motors during the regular course of maintenance, we have used carbon tetrachloride, but due to its toxic effect had to discontinue same. We then tried trichloroethylene which was also found to be very toxic and required us to use a special respirator. We were inclined to think that while it was a good cleaner, it also was a varnish thinner, and was harmful to the

insulation. We then used a Shell T-28 compound; this left a film and was slow in drying and therefore was not a very good cleaner for motor insulation. We are now trying Shell T.S. 28 mixed with 35% perchlorethylene and have not been using it long enough to properly evaluate same.

We require this cleaner for cleaning motors which are isolated and cannot be brought into the shop.

Any help your readers can give me will be most welcome.—J.S.B.

**ANSWER TO E37**—I would like to inform J.S.B. that there is a very good cleaner for motors and other electrical equipment and apparatus, such as he desires, on the market. It is called Brulen Solvent Degreaser manufactured by Brulen & Co., Indianapolis 7, Ind. It is non-toxic, has a very high flash point, dries quickly and does not leave a film or residue. We in our power plant have also used other cleaning fluids but have found this to be far superior than anything we have ever used. I am sure that this solvent would solve his problem.—H.E.K.

**ANSWER TO E37**—There is an excellent product on the market that exactly fits your need. We have used this for some time now and are very well satisfied with the results. It works equally well as an immersion cleaner, spray cleaner, recirculating spray and can be used for gearhead motors and gear reducers. It is called PEMOC P-300 and is manufactured by the Peters Company, Division of Toledo Paint & Chemical Co., Toledo 1, Ohio.—J.A.M.

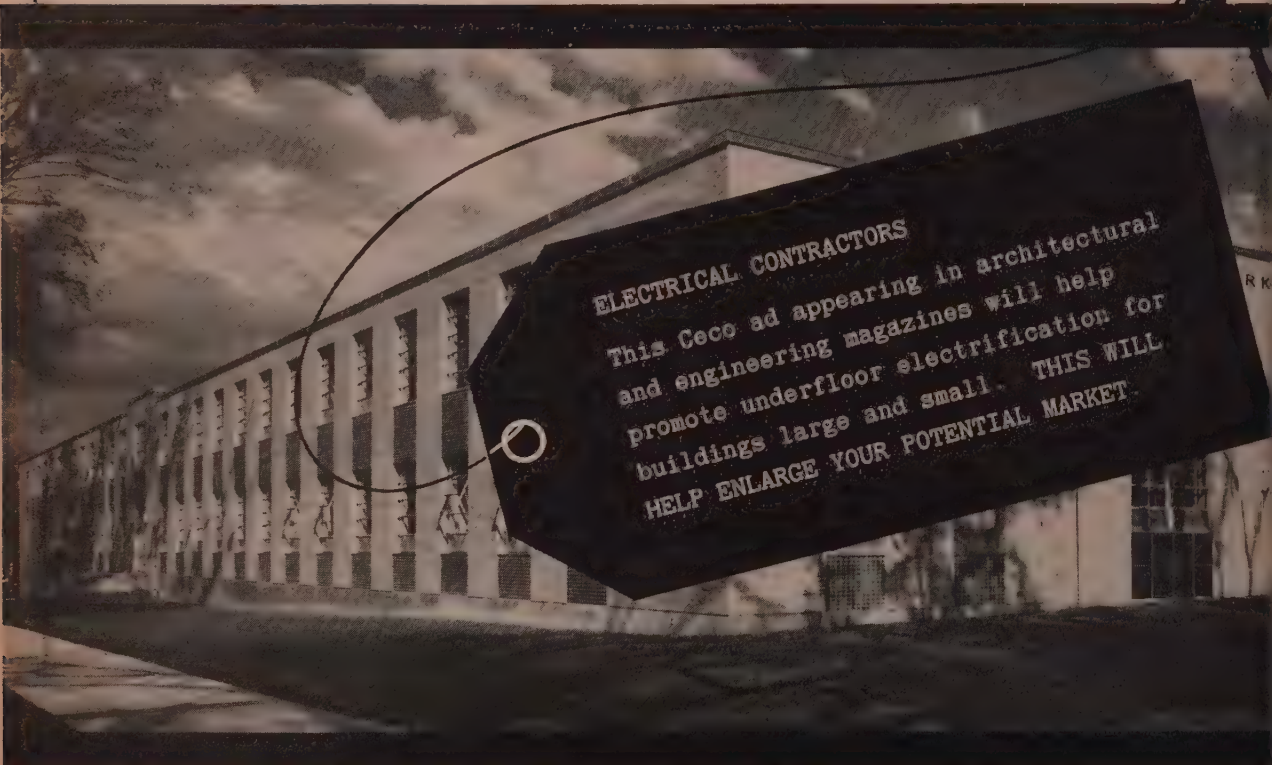
**ANSWER TO E37**—We have tried several solvents and numerous combinations of them in different proportions and have finally found one that answers all our problems—from cleaning motor and generator windings and bearings, degreasing equipment before painting, to removing floor wax for rewaxing.

We find it non-toxic, fast drying, will not leave a film or soft varnish and is non-explosive and non-conductive, but like any solvent, should be used with adequate ventilation.

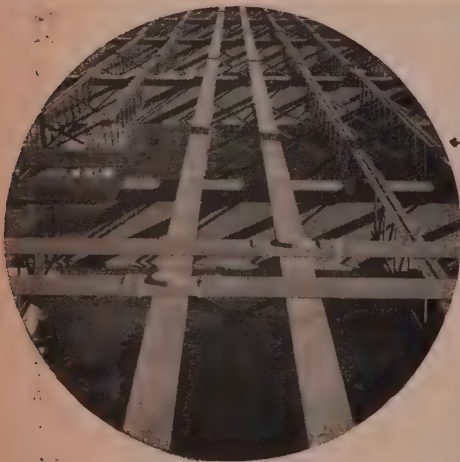
This solvent can be bought in 5-gal cans or in 30- or 55-gal drums (Turco-Solv—Turco Products Inc., Chicago, Ill.).—K.D.L.



*Underfloor Electrification isn't NEW...  
But it's NEWS when a quality system  
offers big savings so any building  
"can afford" electrification*

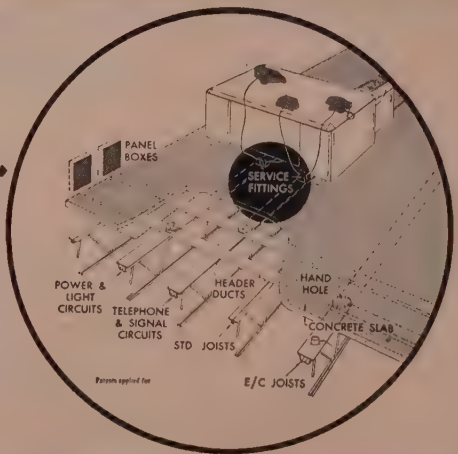


**ELECTRICAL CONTRACTORS**  
This Ceco ad appearing in architectural  
and engineering magazines will help  
promote underfloor electrification for  
buildings large and small. **THIS WILL  
HELP ENLARGE YOUR POTENTIAL MARKET.**



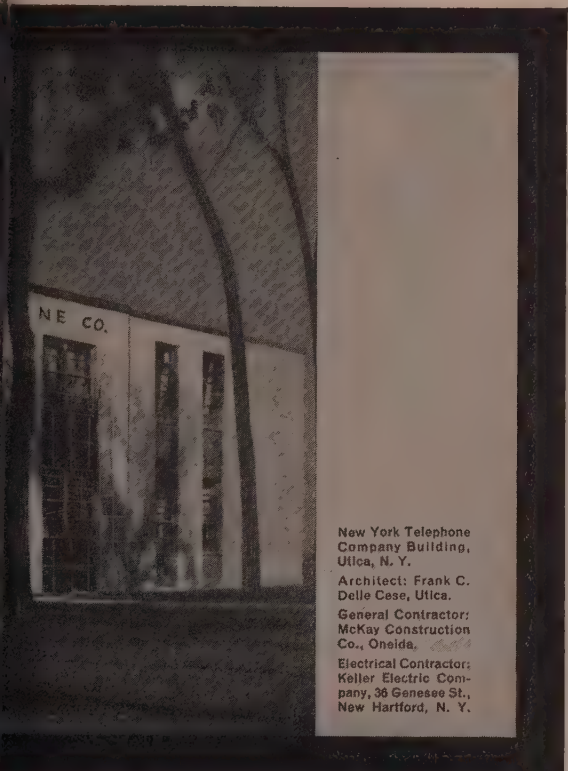
This construction view shows the clean arrangement of header ducts installed on Ceco E/C Joists. These header ducts were installed quickly and economically by an electrical crew which had never before installed a system of underfloor electrification.

Electrical, telephone and signal wires are run from the panel boxes down through the header ducts, into the top chord of the E/C Joist and up through the service fittings to desks located anywhere on the floor. Whenever desks are moved, the fittings can be installed anywhere along the joists to service the new positions. The E/C Joist system is listed by Underwriters' Laboratories for use with standard header ducts and electrical accessories manufactured by General Electric Co., National Electric Division of H. K. Porter Co. (formerly Napco) and Walker Bros. of Conshohocken.



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# CECO'S E/C JOIST SYSTEM OF UNDERFLOOR ELECTRIFICATION ASSURES QUALITY WITH ECONOMY



New York Telephone  
Company Building,  
Utica, N. Y.  
Architect: Frank C.  
Delle Case, Utica.  
General Contractor:  
McKay Construction  
Co., Oneida, N. Y.  
Electrical Contractor:  
Keller Electric Com-  
pany, 36 Genesee St.,  
New Hartford, N. Y.

When a building method offers quality at a cost lower than any competing system, that's a combination hard to beat.

Add to that down-to-earth practicality, plus design that satisfies the future . . . then you can specify with confidence.

Such is Ceco's E/C Joist system of underfloor electrification. Savings are realized because Ceco's E/C Joists do two jobs: 1—provide raceways for underfloor electrification; 2—carry the floor load. Now any building "can afford" underfloor electrification.

These advantages of Ceco's E/C Joist system were proved in the Utica, New York Telephone Company office building.

The architect specified Ceco's E/C Joist system and a commonly used alternate. The successful bidder's figures showed the Ceco system saved 56¢ per square foot compared with the alternate. Read what those concerned have to say:

*Owner, Milton A. Abelow and Daniel B. Myers:*  
"The E/C Joist system satisfied our requirements of avoiding electrical obsolescence for years to come, and we saved a considerable amount of money."

*General Contractor, John T. McKay:*  
"The savings shown in the bids were proven on the job by the Ceco E/C Joist system. I would like to erect more buildings using the same system."

*Electrical Contractor, Reginald Keller:*  
"Installation of the E/C Joist system was practical. Our workmen were able to install it economically, even though they had never installed underfloor electrification using header ducts."

On your next job specify the Ceco E/C Joist system. Send for the facts now. Mail the handy coupon today. Ceco Steel Products Corporation. Sales offices, warehouses and fabricating plants in principal cities. General offices: 5601 West 26th Street, Chicago 50, Illinois.



IN CONSTRUCTION PRODUCTS CECO ENGINEERING MAKES  
THE BIG DIFFERENCE . . . Steel Joists / Steelforms / Concrete  
Reinforcing / Curtainwalls, Windows, Screens, Doors /  
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**CECO STEEL PRODUCTS CORPORATION**  
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EC&M

Please send the following technical literature:

☐ E/C Joist Manual #3011-A ☐ Steel Joist Catalog #3001-O ☐ Joist Load Tables #3009

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☐ If student, check here for special data.



WHAT'S  
**NEW**

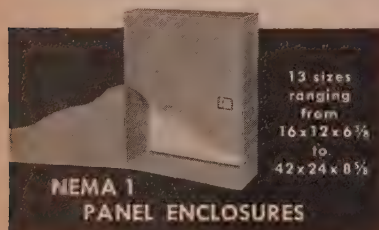
IN

**Hoffman**

## ELECTRICAL ENCLOSURES?



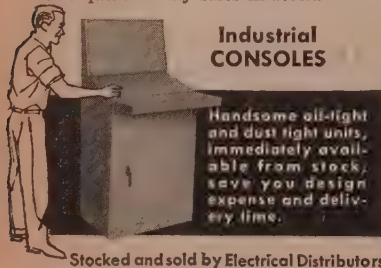
Completely oil-tight and dust-tight. Mounting panel is removable. Standard single door sizes now include many 8" and 10" deep enclosures to accommodate large circuit breakers and disconnect switches. Besides two-door models, we now offer three, four, and five door models up to 15½ feet long. Also available in NEMA Type 4,



A control housing for locations that do not require the oil and dust-tight characteristics of HOFFMAN NEMA Type 12 enclosures. Removable mounting panel. Doors have lift-off hinges and plated "flush" latches.



This new JIC Sectional Wireway (Patent Pending) offers the "lay-in" feature which simplifies installing wires from control point to equipment. Cover has full length hinge and is gasketed to seal out liquids. Many sizes in stock.



Stocked and sold by Electrical Distributors

**Hoffman ENGINEERING CORPORATION**  
Dept. ECM-141, Anoka, Minnesota

**ANSWER TO E37**—We were faced with same problem as J.S.B. We contacted the National Disinfectant Company and are now using their SS-25, Industrial Safety Solvent.

It is corrosion free, specific gravity 1.03, no flash at boiling point, residue on drying 0°, odor sweet, toxicity at least 25 times safer than carbon tet, has never been found to cause or contribute to dermatitis, dielectric constant rated greater than 25,000 volts. May be purchased from: The National Disinfectant Company, 1550 Page Ind. Center Court, St. Louis 14, Missouri, or 33 West 42nd Street, New York City N. Y.—F.E.T.

## Clock Correction

**QUESTION G37**—For the past eight years we have had the International Business Machines system of clock correction, the master clock controlling all indicating wall clocks. This is accomplished by the master clock and transmitters sending impulses out through the 480-volt distribution system, through step-down transformers and into the 120-volt secondary circuits.

The output impulse on these transmitters is 5 volts, 12 amps, 3500-6000 cycles, and are connected to the 480-volt, 60-cycle system.

This year the Utility Company informed us our power factor was low. We purchased a bank of three capacitors, rated at 15 kw each, 480 volts, 3-phase. After connecting them into the 480-volt system, we lost our clock correction feature. The theory being, the capacitors are absorbing the impulses from the transmitters and preventing them from going out into the distribution system.—L.J.B.

**ANSWER TO G37**—Whenever you wish a low impedance to appear as a high impedance, you apply the ac voltage to both sides of the circuit element equal in phase and magnitude. This is used in eliminating

capacitance in long coaxial lines in ac analogue computers. This device may be applied to the clock 480-volt system in this manner.

As you see this is the equivalent of balancing a bridge.—J.A.

**ANSWER TO G37**—Three solutions to the problem expressed exist as follows:

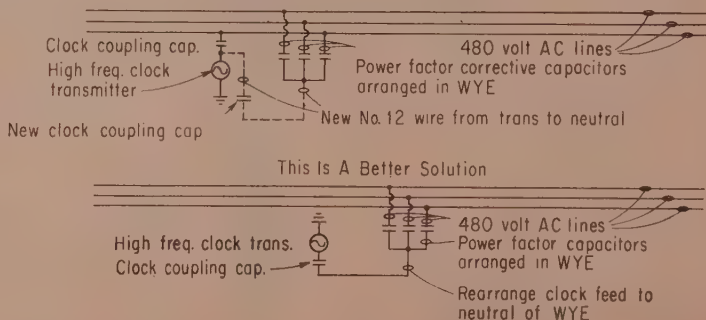
1. It is possible to overpower the attenuating characteristics of the power factor capacitors by replacing the transmitters (60-watt output) with rotary motor generator frequency equipment. Motor generators with ½ kva to 50 kva outputs can be supplied by the Simplex Time Recorder Co., 350 Broadway, N. Y.

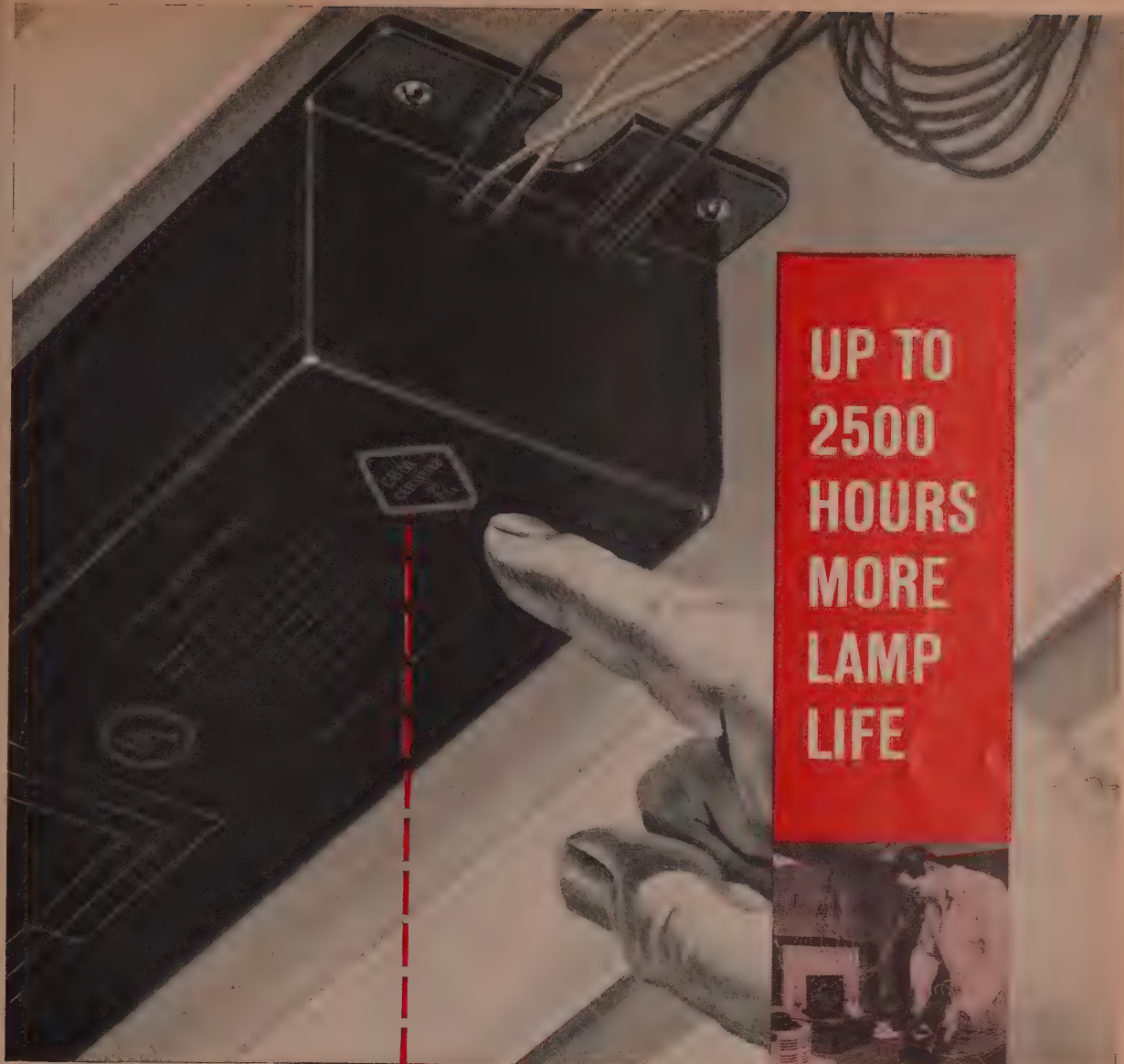
2. Tuned traps (3510 cycles) can be installed in series with the power factor capacitors. These traps will present a high impedance at carrier frequencies but have little or no effect on the 60-cycle loads.

3. An electrically operated contactor can be installed with its contacts arranged to open the circuit to the power factor correction capacitors while the master clock is keying the transmitters. The coil of the electrically operated contactor is operated by the same master clock circuit that keys the transmitters now installed. Since clock correction keying is only effective for 6 seconds every hour, the absence of power factor correction for this short period would be negligible.

In my opinion, the clearest solution is No. 1 since the transmission equipment is fairly old and the many advantages of motor generator equipment over tube type operation are obvious.—A.J.F.

**ANSWER TO G37**—You are correct, because at the 3500 to 6000 cycles the capacitors will act as a short circuit. A resistance in series with each capacitor will remove the possibility of this short circuit occurrence. And at the same time, the power factor correction will not be altered. A choke coil is a better solution.—H.S.





CBM Ballasts are checked by tests regularly, at E.T.L.

**And this is  
one of many  
advantages  
which this  
emblem  
on a fixture  
BALLAST  
assures you!**

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CERTIFIED  
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®

Because this CBM emblem on a ballast case means checked and certified by Electrical Testing Laboratories to definite CBM specifications . . . "Specs" that assure high light output, positive starting, Power Factor correction . . . dependable, rated performance from fluorescent lamps. And of course, UL listing. They bring other benefits, too . . . savings on installation (fewer circuits needed for fixtures CBM-equipped) and more light (from the same number of fixtures).

It pays to specify fixtures equipped with CBM ballasts. For the latest facts, ask us to send you CBM News.

Participation in CBM is open to any manufacturer who wishes to qualify.

CERTIFIED BALLAST MANUFACTURERS, 2118 KEITH BUILDING, CLEVELAND 15, OHIO

ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . FEBRUARY, 1960

2-60

165



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Just a pull of the trigger  
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OLIN MATHIESON CHEMICAL CORP. • WINCHESTER-WESTERN DIV. • 285B WINCHESTER AVE. • NEW HAVEN 4, CONN.

## Can You Answer These QUESTIONS?

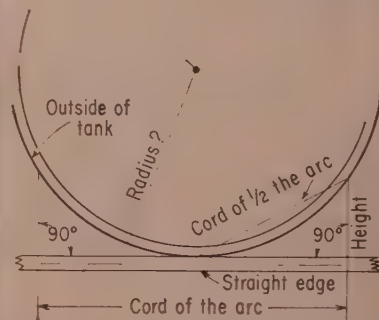
**QUESTION P37**—In our local high school we have a heat problem which is due to incandescent lighting. One room where they seem to have the most trouble, there is 3300 watts. One engineer says if fluorescent lighting had been used the trouble could have been eliminated. Another engineer said that would not make much difference. Which engineer is correct? How many Btu's will 1000 watts of incandescent light give off?

Does 1000 watts of incandescent lighting heat as much as a 1000-watt electric heater? In other words, is part of incandescent lighting heat or other types of losses?—M.D.

**QUESTION Q37**—In a group of six 2½-in. conduits that come through a slab but are not joined to a junction box but are bonded by a ground wire, what rule is applied to size of bond wire?—V.S.

**QUESTION R37**—Most of the ball bearing failures in electric motors cause the rotor to rub the stator which causes motor burnouts before the protective device will trip the current to the motor. What would be good detection for bearings before they completely fail? We have experienced new bearings which failed within a short period causing a complete motor rewind.—E.S.H.

**QUESTION S37**—Shown is a diagram of a conduit bending principle or technique that appears to be a most practical approach to bending problems. However, we came into



possession of the sketch minus a formula for defining its use. Can someone give me the needed formula?—W.A.

**PLEASE SEND IN  
YOUR ANSWERS BY MARCH 15**

# FACTS



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A



# Questions on the Code

Answered by:

**B. A. McDONALD**, New York Board of Fire Underwriters, Rochester, N. Y.

**B. Z. SEGALL**, Consulting Electrical Engineer, New Orleans, La.

**R. E. WARD**, Chief Electrical Inspector, Insurance Department, State of Tennessee, Nashville, Tenn.

## Aluminum Conduit

**Q.** *In the use of parallel aluminum conduits may all like phase wires be run in separate conduits: AAA in one conduit; BBB in another conduit; and CCC in a third conduit?—G.G.M.*

**A.** Yes, the installation may be made in the manner you describe, but in doing so it is imperative that the entire installation be carefully planned to avoid inductive heating in other sections of the installation. For example, the entrance of these aluminum conduits into a sheet steel cabinet would present a definite hazard. It is also possible to create heating at other points in the system if sufficient care is not taken to avoid encircling each conduit line with some magnetic material at points of support, etc.

In general, if a wiring system, such as you suggest, is to be installed, it should be planned to use aluminum throughout for all fittings, cabinets, etc. Not only is this necessary to eliminate possible heating, but also to prevent the possibility of galvanic action due to the presence of dissimilar metals (Section 346-1).—B.Z.S.—2/60/1

## Service Entrance Cable

**Q.** *I have a surplus of approved service entrance cable. Does the National Electrical Code prohibit the running of such cable in conduit when used as specified in Article 338 of the 1959 National Electrical Code?—J.D.*

**A.** No. Comment: Your question is very unusual. However, I have had cases of service cable being run in short straight runs of conduit for mechanical protection or where requirements specified metallic raceway. As far as I can determine, there is no place in the code that prohibits the installation of service cable in conduit when all other applicable requirements for wiring are complied with.—R.E.W.—2/60/2

## Bonding Concentric Knockouts

**Q.** *The inspection authorities in our city require every branch circuit entering a combination service and branch circuit enclosure (the pull out type) to be bonded to ground if it enters through a concentric K.O., and use Sections 2571 and 2572 as their authority.*

*As these sections say nothing about branch circuits entering a service enclosure, I would appreciate your comments on their actions.*—S.O.S.

**A.** As you intimate, the provisions of Sections 2571 (250-71) and 2572 (250-72) concern the Bonding of Service Equipment. For the convenience of our readers, the provisions of Section 2572-d (250-72d) which concern the continuity at service equipment, read as follows:

"Bonding jumpers meeting the other requirements of this article. Bonding jumpers shall be used around concentric or eccentric knockouts which are punched or otherwise formed so as to impair the electrical connection to ground."

This rule first appeared in the 1940 Code, and reference to the Analysis of the 1940 Code compiled by A. B. Smith for the National Electrical Manufacturers Association reveals the following comment:

"The wording is such as to permit omission of the bonding for designs of knockouts which provide a good electrical connection."

As a result, the bonding of concentric knockouts, which are in the service grounding circuit, is not required in all cases. It follows, however, that the inspector has the responsibility for interpreting the wording of Section 2572-d (250-72d).

In connection with the branch circuit conduits which enter the service equipment, it is my opinion that the provisions of Section 2572-d (250-72d) do not apply. There is a distinction between an unprotected service conductor, and one which is adequately protected by a branch circuit overcurrent device. When a fault occurs on a service conductor,

the current is only limited by the primary fuse at the transformer. As a result, considerable arcing will occur at the fault, and if there are other weak spots in the path to ground, arcing will also occur at such places. When a fault occurs on the branch circuit conduit, we have overcurrent protection on the circuit, and also the main overcurrent device to limit the destructive current.

Reference to page 128 of Abbott's N. E. Code Handbook, shows an illustration of a service entering a combination main service switch and overcurrent device serving a feeder. Bonding bushings are shown where the service conduit enters the main switch and where the feeder conduit enters the enclosure. The following is given:

"The jumper method is required if the service raceway enters the box through a concentric knockout unless the knockout is so formed as not to impair the electrical conductivity to ground. It is desirable, though not required, to connect the feeder raceway to the box in the same manner as the service raceway."

While the code does not specifically cover the status of concentric knockouts with respect to feeder and branch circuit conduits, it appears that the following fundamental rules give the inspector considerable latitude when deciding such a question:

"Section 2551 (250-51) Effective Grounding. The path to ground from circuits, equipment, or conductor enclosures shall be permanent and continuous and shall have ample carrying capacity to conduct safely any currents liable to be imposed on it, and shall have impedance sufficiently low to limit the potential above ground, and to facilitate the operation of the overcurrent devices in the circuit."

"Section 3016 (300-10) Electrical Continuity of Metal Raceways and Enclosures. Interior metal raceways, cable armor, and other metal enclosures for conductors, shall be metallically joined together into a continuous electrical conductor, and shall be so connected to all boxes, fittings and cabinets as to provide effective electrical continuity."

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T460

Side View

Front terminal for easy



## SPECIFICATIONS for T460, T462 Thermostats

|                       |                                                                                                                                                                                                                                                    |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MODELS:               | T462A, T460A, T460C—break one side of line, in "No Heat" position. Scale markings: "No Heat", 1, 2, 3, 4 (maximum setting)<br>T462B, T460B, T460D—break both sides of line, in "off" position. Scale settings: "Off", 1, 2, 3, 4 (maximum setting) |
| RANGE:                | 50—80° F.                                                                                                                                                                                                                                          |
| ELECTRICAL RATING:    | (heater load) 5,000 watts, (22 Amps.) 230 V. AC.                                                                                                                                                                                                   |
| THERMAL DIFFERENTIAL: | ½° F.                                                                                                                                                                                                                                              |
| SWITCHING OPERATION:  | T462A, T460A, T460C, SPST; T462B, T460B, T460D, SPST—with DPST in "off" position—for applications requiring both of the lines to be broken whenever the thermostat is in the "off" position).                                                      |
| DIMENSIONS:           | 4½ x 2¼ in., setting dial extends 15/16 in. from wall; Extension into outlet box; T462A and T460A, ½ in.; T462B and T460B, ¾ in. (See illustrations above).                                                                                        |
| MOUNTING:             | Mounts vertically on standard 2 x 3 in. standard outlet box. An Adaptor plate for horizontally-mounted outlet box available at extra cost.                                                                                                         |
| FINISH:               | Silver-Bronze.                                                                                                                                                                                                                                     |

### WHEN ORDERING SPECIFY:

1. Model Number
2. Special Features.

SPECIAL FEATURES: T460C (SPST), T460D (SPST—with DPST in "off" position)—special "strip-down" models (less cover, shorter body) available in quantities for factory mounting in baseboard units or wall heaters.

The new standard, light silver-bronze finish of the T460 lends itself well to any decor. Yet, where it is preferred to add a custom decorator touch, the cover (plain metal) is easily removed, and can be painted to match the wall. Painting this cover is especially easy, because it requires no careful brush work around trim, etc.



## T40A Line-Voltage Thermostat

This thermostat is primarily used to provide line-voltage control where a rugged thermostat is of prime importance. Because it is available in low temperature scale ranges, it is widely used in such farm buildings as milk houses and pump houses, as well as in certain other industrial installations, where freeze-up protection is a main consideration. Special features include a removable temperature adjusting knob and locking cover, which safeguards against tampering.

**ELECTRIC RATING:** Non-inductive (resistance) loads. 17.6 amp. (4200 watts) at 115 or 230 volts, ac.  
**RANGES:** 36 to 64° F.; 42 to 75° F.; 56 to 84° F.

# Honeywell



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It is quite evident, from the foregoing rules, that an inspector who observes a conduit connected through a concentric knockout which impairs the connection to ground, has just reason to require the bonding of such a connection. This observation applies not only to the branch circuit conduit which enters the service equipment, but to other points of connection beyond the service equipment. On the other hand, a concentric knockout which has not been impaired requires no bonding jumper. In so far as services are concerned, bonding is required regardless of the type of knockout. — B.A.McD. — 2/60/3

## Trailer Park

**Q.** For a trailer park for five units:

5—3-wire, 60-amp meter sockets, supply:

5—1-phase raintight panels each having a range receptacle and other arrangements to supply its trailers with the following:

- general lighting
- a water heater
- small appliances
- 1 air conditioner.

These five meters are all fed by three No. 2 RH conductors through a service conduit and gutter. Does this No. 2 meet NEC demand requirements?—C.H.A.

**A.** In the absence of any specific rules in the National Electrical Code applying to trailer parks and trailer coaches, we must seek other sources for answers to this problem. The NFPA has a standard No. 501 which covers "Fire Prevention and Fire Protection in Trailer Coaches and Trailer Courts — 1952, reprint 1959."

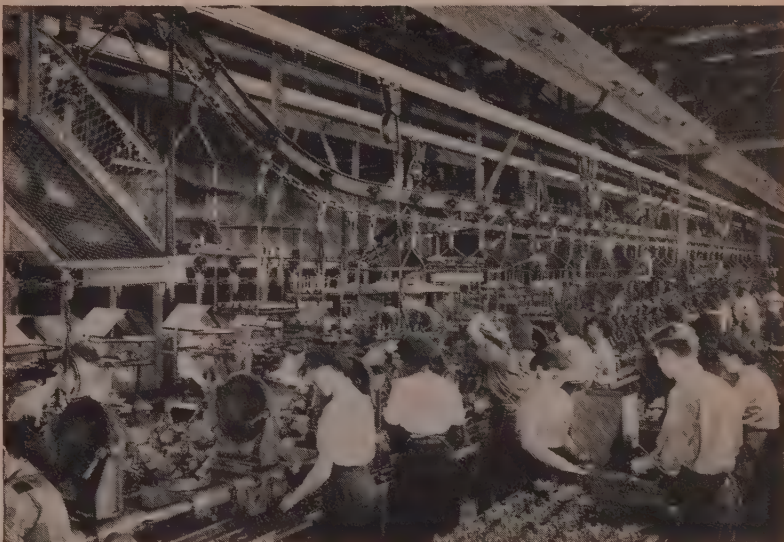
In Chapter 4 of this standard Article 410—General, states as follows:

"All electrical equipment and materials shall be installed in accordance with the provisions of the National Electrical Code where applicable. Wherever the National Electrical Code and the standard for trailer coaches have unlike requirements, the requirements in the trailer coach standard shall apply. Good service and satisfactory results will often require larger sizes of wire, more branch circuits and better types of equipment than the minimum which is here specified."

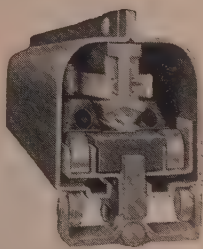
In Article 430 it is recommended that two No. 12 copper wires, or the equivalent, appliance and general

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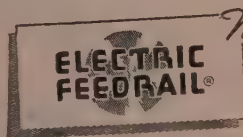
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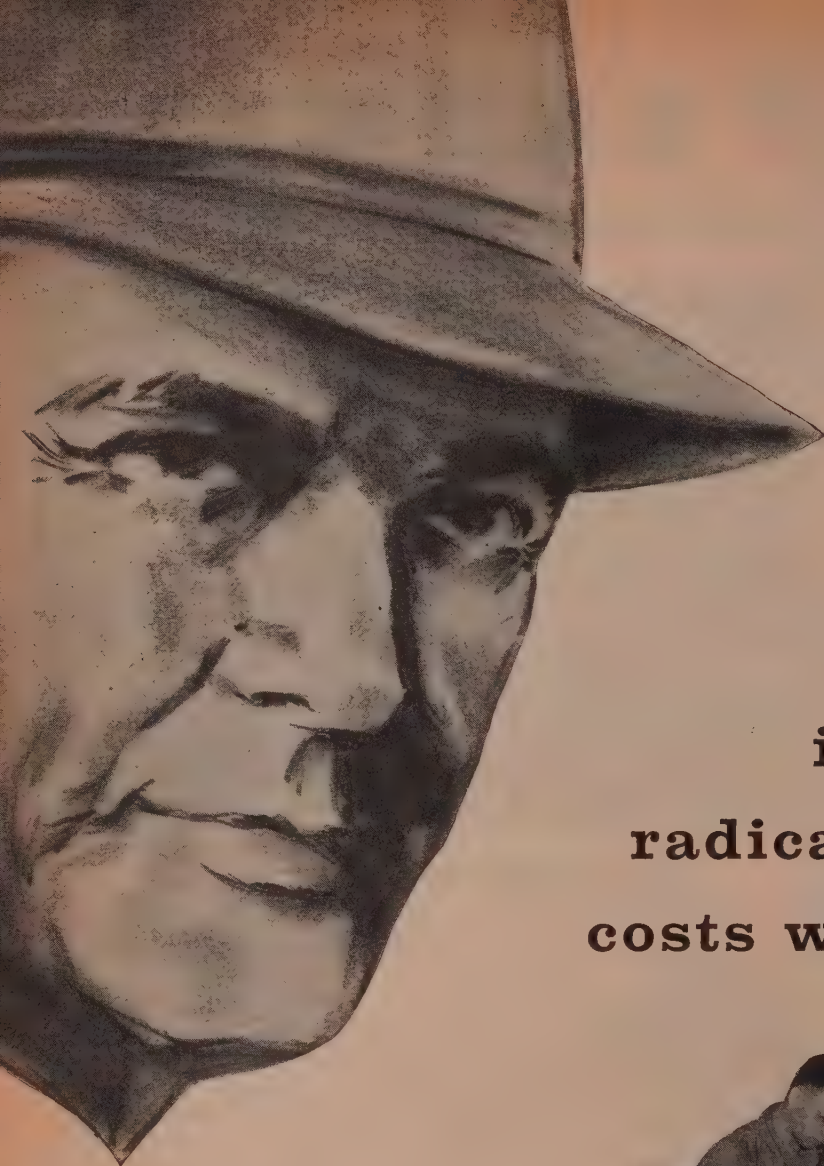
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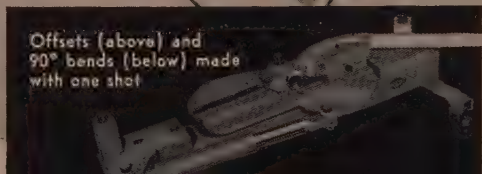
As the bidding gets tighter and the profit squeeze grows tougher, today's smartest contractors are "tooling up" in every practical way to streamline operations — *control costs!*

Many are finding the answer in *Job-Profit Tooling* by Greenlee. It saves costly materials, mechanizes much of the work previously done by hand — assures extra efficiencies, better final results, *more net profit per job!*

To illustrate—the new Greenlee Multi-purpose Hydraulic Bender at right makes offsets *in seconds* with one setting, one shot. Other Greenlee Job-Profit Tooling ideas to bring you additional time and materials savings are shown on the facing page.



Offsets (above) and  
90° bends (below) made  
with one shot





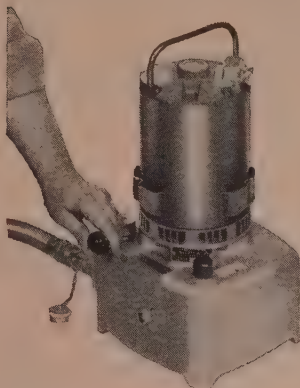
**IDEA FOR FAST, ON-THE-JOB CONDUIT BENDING**—Greenlee No. 84 Lightweight Hydraulic Bender with portable power pump, shown above, makes 90° bend in 4" conduit in about our minutes with one shot. Handles ½"-4" sizes of steel and aluminum conduit and pipe.

Greenlee Lightweight Hydraulic Benders are also available in two other models: No. 880-M2 for ½"-2", and No. 883 for ½"-3" conduit and pipe. No. 880-M2 with power pump makes 90° bend in 2" conduit in less than a minute. No. 883 with power pump makes 90° bend in 3" conduit in about a minute.

All models make full 90° bend with one ram stroke and are easily operated by one man with hand or power pump. Portable . . . carried by one man or wheeled from job to job on pipe supports which serve as rollers. Conduit is

easily inserted and removed from front of bender . . . "Quick-Removal," positive-locking support pins cannot come loose. Attachments also available for bending thin-wall, bus bar, and tubing.

The Greenlee line also includes segment-type hydraulic benders, hand benders, and ratchet hand benders to give you a full complement of tooling for speeding every conduit-forming job.

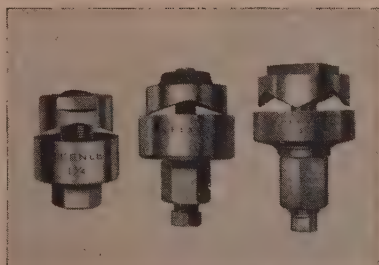


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punches already owned or in handy sets with 6 or 10 punches.

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purpose branch circuits be installed. In Article 440 the supply connections are recommended to be at least No. 10 AWG copper conductors or optionally in a Type S. cord of the same size.

In Article 430 the two branch circuits are recommended to be installed to supply load in the following manner:

One circuit to supply outlets generally used for the connection of appliances.

One circuit to be used for general lighting, in addition to not more than a maximum of 1000 watts of permanently connected appliance load such as an electric water heater.

In this particular case the loads in these trailer coaches seem to be beyond the minimums specified in this standard. I would, therefore, use the general requirements of the NEC to arrive at a more realistic value of load requirements.

Upon this basis let us assume some minimum values for the various loads in these coaches:

Range, 5 kw, 115/230 volts

Water heater, 1 kw, 230 volts

Air conditioner, 1 hp, 230 volts

It will also have to be assumed that all three of these major appliances could be in operation at the same time.

The range in accordance with Column C of Table 220-5 would have an individual demand of .8 x 5 or 4 kw. At 230 volts this would be a demand of 4000/230 or 17.4 amps. For five ranges the demand factor decreases to 45% so that the total service demand current would be

$$\frac{.45 \times 5 \times 5}{230} \text{ or } 49 \text{ amps.}$$

The water heaters would have a demand per coach equal to the rating of the heater or 1000/230 or 4.3 amps. For the service the five heaters would have a demand factor of .75 (see Section 220-4j) so that the total service load would be 4.3 x 5 x .75 or 16 amps.

The air conditioning unit would have to be figured at total rated values both for the individual coach and for the service feeder. A standard 1 hp unit would have about 8 amps full load (disregarding any electrical heating load). The total service demand would be 40 amps.

We will finally assume that the total small appliance and general lighting load will not exceed 3000 watts (although the 1959 Code requires at least 3000 watts for the small appliance load alone—Section 220-4h). On the basis of each coach the demand would be 3000/230 or 13 amps. For the five trailers the total

wattage would be 5 x 3000 or 15,000 watts.

The service demand would be based on the following (Table 220-4a).

|               |            |
|---------------|------------|
| 3000 @ 100%   | 3000 watts |
| 12,000 @ 35%  | 4200 watts |
| (15,000—3000) | 7200 watts |

The total demand would be 7200/230 or 31 amps.

The individual service to each coach would require a minimum feeder based on the following:

|                  | amps |
|------------------|------|
| Range            | 17.4 |
| Water heater     | 4.3  |
| Air conditioning | 8.0  |
| Lighting, etc.   | 13.0 |
| Total            | 42.7 |

A 60-amp, 3-wire service should be sufficient for each coach.

As for the total service, we have

|                  | amps  |
|------------------|-------|
| Ranges           | 49.0  |
| Water heaters    | 16.0  |
| Air conditioners | 40.0  |
| Lighting, etc.   | 31.00 |
| Total            | 136.0 |

The minimum size would be 3 No. 2/0 Type R, or 3 No. 1/0 Type RH (Copper).—B.Z.S.—2/60/4

## Cables in Concrete Floors

**Q.** Section 422-37 of the 1959 National Electrical Code, subject being installation of cables in concrete or poured masonry floors, states in part:

"(a) Adjacent runs of cable not exceeding 2½ watts per foot shall be installed not less than 1 in. on centers."

Does this prohibit the use of cable of higher wattage than 2½ watts per foot for use in concrete floors?

—J.E.G.

**A.** No. This question has been raised by one of the manufacturers of electric heating materials. There was some disagreement on the matter between some of the members of the original Technical Sub-Committee on Electric Heat. This question has been submitted to members of Code Making Panel No. 10 and I quote from a letter of December 4th signed by Merwin Brandon, Chairman, Electrical Section of the National Fire Protection Association regarding your question and which is self-explanatory:

ANOTHER ADVENTURE  
IN LOW-VOLTAGE WIRING  
WITH

# REMMIE REMCON

and  
**ALEC TRISHUN**

"ALEC'S DREAM HOUSE"

BOY, DO I ENVY THE OWNER OF  
THIS HOUSE. REMMIE, THIS REMOTE-  
CONTROL SWITCHING IS GREAT!  
I'M GOING TO HAVE IT IN MY  
HOUSE WHEN I BUILD!

WHY NOT?  
MODERN REMCON  
LOW-VOLTAGE WIRING  
IS EASY TO INSTALL.  
NO CLUMSY ARMORED  
CABLE TO RUN... NO  
SEPARATE LOW-VOLTAGE  
POWER SUPPLY.



AH, I CAN SEE IT ALL NOW!  
MY WIFE COMES HOME WITH AN  
ARMLFUL OF GROCERIES AND  
LIGHTS HER WAY THROUGH  
THE HOUSE FROM SWITCHES  
IN THE GARAGE... THEN  
TURNS THEM ALL  
OFF FROM THE  
KITCHEN.

RIGHT, ALEC.  
REMCON "LIGHT-  
PATH" SWITCHING  
SURE IS  
CONVENIENT.  
NO FUMBLING IN  
THE DARK... NO  
RETRACING  
STEPS.



AND WHEN GUESTS  
VISIT... SHE CAN  
TURN ON THE PORCH  
LIGHT FROM THE  
KITCHEN AND  
STILL HAVE TIME  
TO TAKE OFF HER  
APRON BEFORE  
GREETING THEM.

THAT'S REMOTE  
CONTROL  
SWITCHING FOR  
YOU. YOUR GUESTS  
KNOW YOU'VE HEARD  
THEIR RING AND  
ARE ON YOUR  
WAY. THEY'LL  
APPRECIATE IT.



YES, AND WITH  
PILOT-LIGHT INDICATION,  
YOU CAN TELL WHICH  
LIGHTS ARE ON THROUGH  
THE HOUSE.

THEN BEFORE WE  
GO TO SLEEP, WE'LL  
TURN OUT ALL THE  
LIGHTS IN THE HOUSE  
FROM THE MASTER  
SWITCH AT OUR  
BEDSIDE.




AND IF MY TWO KIDS WANT  
DRINKS DURING THE NIGHT,  
EITHER OF THEM CAN TURN  
ON THE STAIRWAY  
LIGHT FROM THEIR  
BEDROOMS.

GEE, REMMIE,  
WON'T IT BE  
WONDERFUL?

ALEC, M'BOY,  
MULTI-POINT  
SWITCHING IS  
WONDERFUL. AND  
REMCON IS THE  
MOST ECONOMICAL  
WAY TO GET IT!



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TRANSFORMER MEANS SIMPLER  
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"Subject: Paragraph (a), Section 422-37, National Electrical Code

"While all of the members of the Panel have not recorded their views on the intent of the above indicated paragraph, the majority are of the view that there was no bar to the recognition of heating cable with a rating in excess of 2½ watts per foot, provided the cable was tested under the spacings proposed for its use and found acceptable.

"Mr. Turnbull, former chairman of the Panel, pointed out that Paragraph (d) of Section 422-23 contemplated further developments along the lines of this particular proposal, so the known producers of electrical space heating equipment and Underwriters' Laboratories are being informed of this situation, with the indication that the way is open to developments along the lines of higher-rated units."

You will note from Mr. Brandon's letter that former chairman of the Panel, Mr. Turnbull, pointed out Paragraph (d), Section 422-23 of the National Electrical Code, which states:

"(d) Electrical space heating systems employing methods of installation other than covered by Part E of this Article may be used only by special permission."

You will also note the latter part of Mr. Brandon's letter states that the way is open to developments along the lines of higher-rated units. Therefore, I am of the opinion we will have higher wattage cable for this use in the future.—R.E.W.—2/60/5

## Grounding Electrodes

**Q.** Section 250-81 requires ground connection to metallic underground water piping system where such a system is available. Section 250-112(a) requires a bonding jumper around the water meter, valves, etc. which are liable to be disconnected if the connection is made to the house side of the meter.

Many cities are installing non-metallic street water mains. Will metallic water piping between the house and the street main be a sufficient ground?—C.H.

**A.** For the convenience of our readers the rule in question reads as follows:

"250-81. Water Pipe. A metallic underground water piping system, either local or supplying a community, shall always be used as the grounding electrode where such a

# Make EXTRA money with *Smithcraft* SPEEDOMATIC TROFFERS

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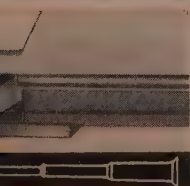
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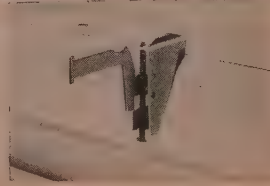
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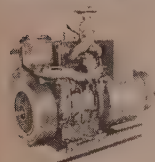
# 112

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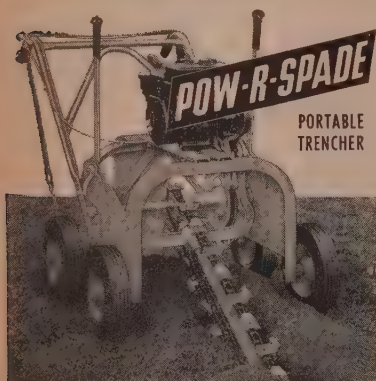


Here's rare news for these days: prices cut on every single model in this great all-purpose Universal line of electric light and power plants. They were reasonable before. They're even greater bargains now — starting as low as \$195. And look at the choice in this newly-expanded line! It gives you power for every purpose big or small, for emergency, intermittent, or constant use. Get complete facts on this fast-moving economy line, famous for rugged reliability and trouble-free operation.



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piping system is available. If the buried portion of the metallic piping system is less than 10 ft (including well casings bonded to the piping system) or there is some likelihood of the piping system being disconnected, it shall be supplemented by one or more of the grounding electrodes recognized in Sections 250-82 and 250-83.

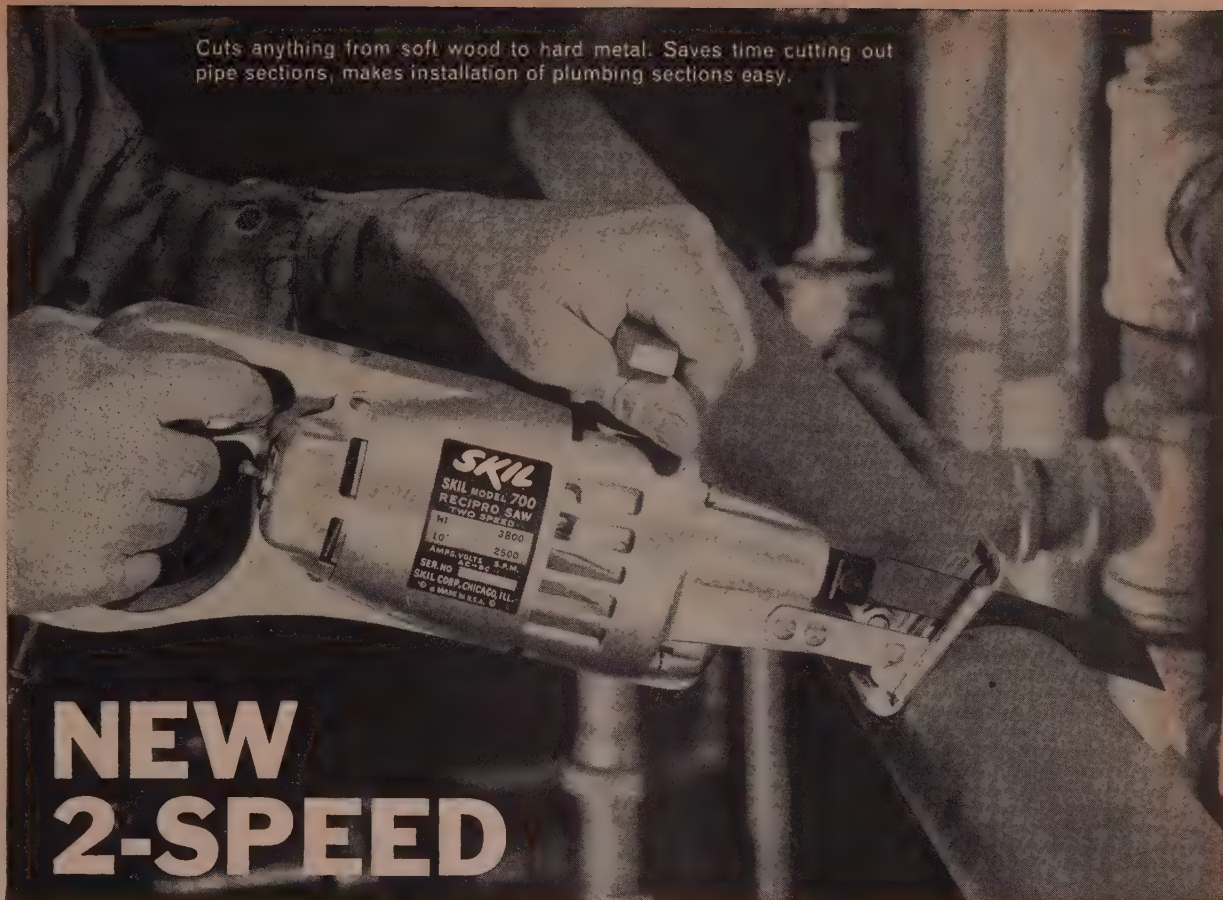
Under the circumstances described in your question, we do not have a complete metallic underground water piping system. We do however, have several feet of underground metallic pipe which connects the metallic water system in the building to the non-metallic street water mains. If we compare this situation with a local water-piping system, which is common on farm properties, it appears evident that when the buried portion is 10 ft or more in length, it is considered to be an acceptable grounding electrode. If it is less than 10 ft in length it is not considered to be an acceptable electrode, but it must be used as such and supplemented by one or more of the grounding electrodes recognized in Sections 250-82 and 250-83.

This opinion appears to be verified by the following quotation taken from an article "The Philosophy of Grounding" written by L. S. Inskip, Chairman of Panel 5, NFPA National Electrical Code Committee:

"Section 250-81 requires that a metallic underground water piping system shall always be used as the grounding electrode. Water pipes make the best ground, primarily because they usually present a large surface of metal in contact with the earth and the resistance to earth is therefore generally low. The pipes also appear throughout the house, and if some other electrode were used for grounding the circuit and equipment, potentials could appear between the circuit or equipment and the water pipe. In other words, the presence of metallic water pipe in the building makes it essential to use the underground water pipe as the grounding electrode if it is metallic.

"It similarly follows that if there is metallic water piping within a building and the incoming service is non-metallic pipe, such as Transit or plastic, the presence of the metallic piping in the building makes it essential to include it in the grounding path for safety to the occupants of the building and to reduce the likelihood of lightning failure of equipment or the energizing of equipment at potential with respect to other grounds.

Cuts anything from soft wood to hard metal. Saves time cutting out pipe sections, makes installation of plumbing sections easy.



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"A private water system may be higher in resistance to ground than a public water system. However, a private system generally is better than a ground rod, because the water pipe is usually buried below the frost line in Northern areas, and also is in permanently moist soil. More area of buried piping between the house and the well or pump, including the well casing, is obtained than would be practicable to obtain through driven rods or pipes. The use of the private water system for grounding also avoids arcing in the house and the consequent fire hazard. Major protection is also given to the pump motor and to electric water heaters connected to the private water system.

The question is frequently raised as to what to do where the water piping to the building is plastic and the interior piping is metal. The code covers that now in Section 258-81 by requiring supplemental electrodes where the buried metallic piping is less than 10 ft in length."—B.A.McD.—2/60/6

### Clothes Dryer Wiring

**Q.** Is it a requirement that all three conductors of a circuit to an ordinary domestic clothes dryer be insulated or would all code requirements be met if there were two insulated conductors and one bare conductor?—M.R.L.

**A.** Section 338-3 (b) states: "(b) Service-entrance cables without individual insulation on the grounded conductor may be used only for range, wall-mounted oven and counter-mounted cooking unit, and clothes dryer circuits, or as feeders from a service cabinet to supply other buildings, or as service-entrance conductors for such other buildings, when the following conditions are met:

(1) The cable has a final non-metallic outer covering.

(2) The supply is alternating current not exceeding 150 volts to ground."

From the above you will note that service-entrance cable may be used for clothes dryer circuits without individual insulation on the grounded conductor when certain conditions are met.

If it is desirable, and the load to be served does not require wire size of approved service-entrance cable, it is the writer's opinion that all three conductors would require insulation if the three conductors are current-carrying conductors, which is usually true.—R.E.W.—2/60/7

*For the U.S. Army Missile Master—*

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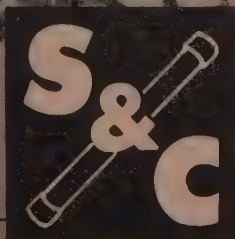
Specified as part of this ultra-reliable nerve center of the Nation's defense are S&C Metalclad Switchgear units, using Power Fuses and Load Interrupters. See inset, left.

Such installations will be used in many areas throughout the United States, where NIKE installations protect population and industrial centers.

For further information about S&C Metalclad Switchgear, write to S&C Electric Company, 4433 Ravenswood, Chicago 40, Ill.

Missile Master Power Substation showing S&C Metalclad Switchgear. The principal contractor: The Martin Company, Orlando, Florida, with Airborne Instruments Laboratory, American Machine & Foundry Company.

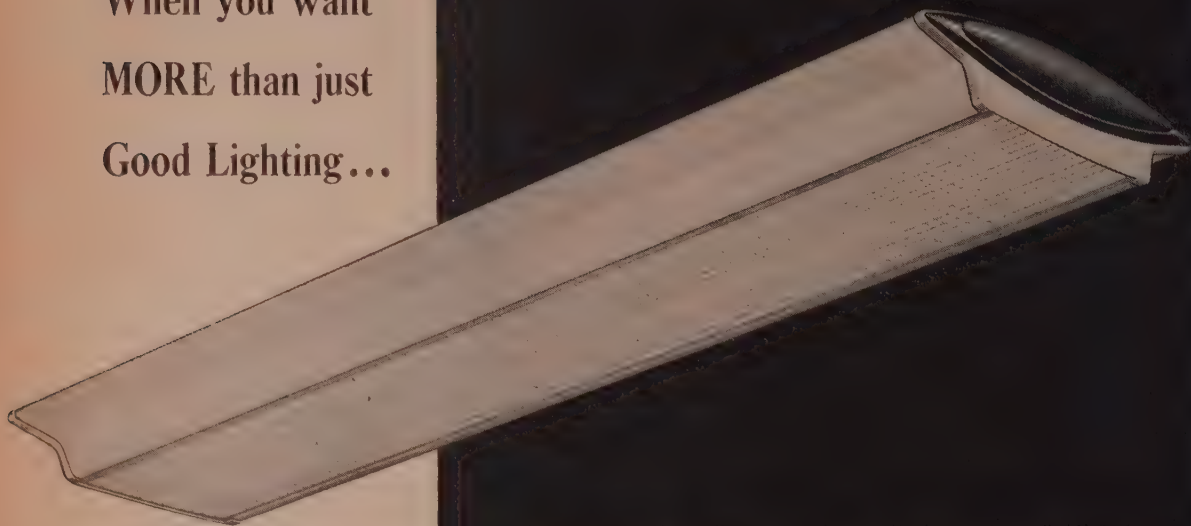
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And the practical aspect has not been ignored either. In addition to its extreme attractiveness, the CLASSIC also provides other important features . . . high-quality lighting characteristics and excellent installation and maintenance advantages.

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## Plant Maintenance & Engineering Conference and Show Held in Philadelphia

Plant engineering and maintenance chiefs from 50 states converged on Philadelphia, Pa., January 25-28, for the 11th Plant Maintenance and Engineering Show and a concurrent conference program. Total show attendance was estimated in excess of 20,000.

The Conference program covered a wide range of topics relating to the interests of plant engineering and maintenance personnel. The conference was under the direction of L. C. Morrow for Clapp & Poliak, Inc., producers of the trade show.

Harry Monroe, general foreman of maintenance, Rocketdyne division, North American Aviation, Inc., Canoga Park, Calif., divided maintenance into three categories to help find "true maintenance costs for purposes of comparison"; long-term, preventive and emergency. The percentage of each varies in individual plants. For electrical equipment, he placed relamping under "long-term" while switchgear inspection and repair, and electric motor inspection and repair were noted as "preventive."

To reach comparison costs, he said, it is necessary to regard the firm's attitude on what kind of

maintenance is established, preventive or "fix-it-when-it-fails." In the former, maintenance money is expended for competent maintenance mechanics, while in the latter, maintenance money is used for machine replacement or other capital-type replacement employing only a minimum maintenance force. Usually the firm manufacturing on tight schedules elects the preventive methods to minimize machine downtime.

Electric motors, he stated, "have reached the acme of engineering achievement." They may easily outwear the equipment they drive and with nominal maintenance—mainly lubrication and cleanliness—will run indefinitely. He listed five causes of motor failure; improper application, inadequate overcurrent protection, lack of maintenance, frequent starts and overloads, and limited built-in reliability.

On relamping programs, he noted that there is general concurrence that 18,000 hours are considered the average life of the fluorescent lamp. One plan mentioned involved a complete replacement program every 24 months with no spot replacement or cleaning during this period. He quoted a report that with 8-ft 430 ma lamps only 1.6% failed in the first 12 months, whereas at the end of 24 months, 10% had failed. Fixture washing and lamp replacement gave a gain of 57% in footcandles. Another program cited involved total relamping every 30 months, fixture washing every 15 months, and spot replacement of lamps on failure.

A. J. Monta, chief engineer, Welch Grape Juice Co., Inc., Westfield, N. Y., reviewed some of the problems related to sanitation control in food plants. In designing the construction, every method, idea and kind of equipment that is easy to clean and will remain clean, must be considered, he said.

In reference to switchgear, he noted that it must be totally enclosed. Drip-proof motors were originally thought to be adequate but due to heavy washing and hosing of the plant, it was learned that totally enclosed fan-cooled motors were necessary if it is expected to operate on a 100% basis.



**OHIO SHOP OWNERS** join in greeting their association's national president, Horace C. Blenkhorn (right), of Blenkhorn & Sawle, Ltd., St. Catharines, Ont., Canada, at a recent conference. From left: L. Earl Miller, Springfield (Ohio) Electric Motor Co.; Don Ossenbaugh, J. L. Hughes Electric Co., Columbus; Selden F. High, The Sullivan Electric Co., Cincinnati; and John C. Wagner, Electric Motor Service Co., Cincinnati.

"It is important that all areas be well lighted," he said. "In addition to providing the light necessary for seeing, it is an inducement to personnel to keep the place clean. We must also protect the fixtures from the steam and water used in cleaning. Care must be taken to place lights in such a position or have them so protected that, if broken, glass will not fall into the product. We use fluorescent and incandescent lamps with plastic or net protection."

Training maintenance apprentices and supervisors was the subject of an address by John L. Peterson, manager, trade and technical training, The Firestone Tire and Rubber Co., Akron, Ohio. He explained the important phases of a well-organized program of apprentice training citing six basic points; determine the objectives, make the program flexible, development of apprentices, adequate records and follow-up.

He laid particular stress on objectives. "In too many cases," he said, "companies use apprentice training as a means of filling a vacancy of a technical nature . . . we should . . . train people to meet the needs of the skilled shortages as they exist in the trades."

Procedures for care of electronic instruments and controls were discussed by F. E. Dandois, instrument foreman, Westvaco Division, Food Machinery & Chemical Corp., South



**COMPARING NOTES** on business conditions in North Carolina at the recent NISA Southeastern Chapter annual conference in Raleigh were W. G. "Bill" Baynard (left), Brook Motor Corp., Charlotte, N. C., and Earl Finch, Ace Electric Co., New Bern, N. C.



**DRI-TRANS**—now supplying the new Kaiser Center, Oakland, Calif. with a distribution system of 6000 KVA capacity.

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**CONSULTING** electrical engineer Willis Lipscomb (standing) designed unique 12-kv underground loop distribution system which was recently installed to serve new San Diego marine terminal. All physical features of terminal were planned by Harbor Engineer Joachim Liebmann, pictured above during conference concerning coordination of electrical with structural elements of the installation.

Charleston, W. Va. Caring for about 1500 major instruments and their sensing devices requires a force of 15 mechanics specializing in this work.

The speaker recommended particular care in the replacement of electronic tubes, citing "the most dangerous common practice" in maintenance procedure as the indiscriminate changing or substitution of tubes, especially "raw" or unaged tubes. A tube which has given 100 hours of operation has an 80% better chance of giving another 100 hours of operation than a new tube, he reported.

Ronald H. Secrest, vice president, S&M Electric Motor Repair, Inc., Trenton, N. J., described methods employed for testing the insulation of polyphase motors and how insulation life can be predicted. He cited mechanical vibration and mechanical damage as major causes of insulation breakdown. He described a convenient method of between-phase testing by taking advantage of the dual voltage motor connections. When all external connections are opened half of each phase winding is entirely isolated and can be tested with respect to other windings. When motors are rewound he recommended that three additional leads be taken from the extreme end of the phase windings so that the complete winding can be tested phase-to-phase.

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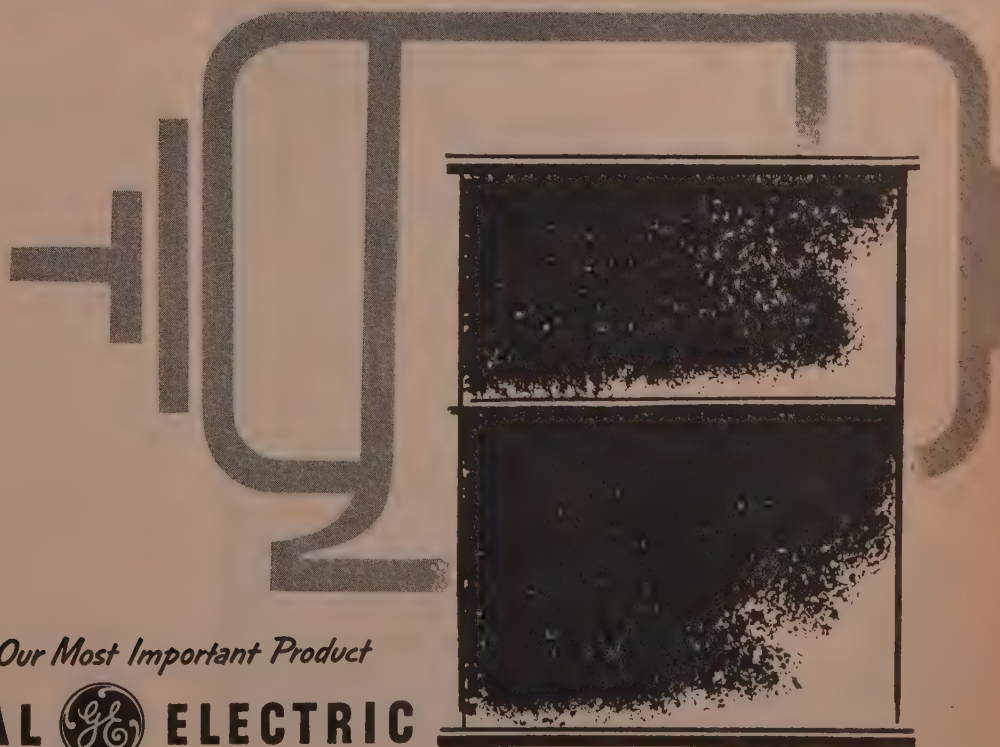
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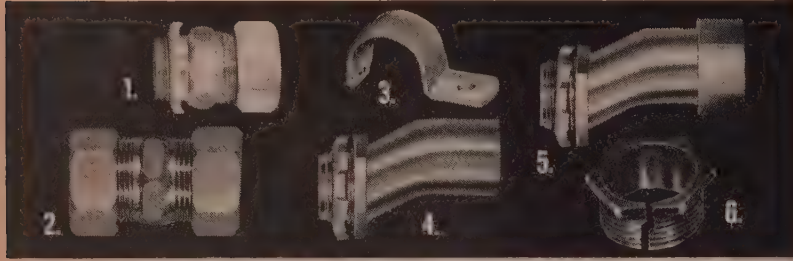
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## Peter Hicks Named President of IAEI

Peter J. Hicks, Jr., chief electrical inspector of the City of Providence, R. I., was named president of the International Association of Electrical Inspectors.

Mr. Hicks, who served as vice president of IAEI during the past year, is an executive board member of the Roger Williams Chapter, IAEI, in Providence and is the city's delegate to the National Mayor's Conference on Electrical Codes.

A Providence employee since 1928, Mr. Hicks is deputy building director and public service engineer of the city. He also serves as secretary of the Rhode Island State Board of Electrical Examiners.

## GE Launches Total Electric Home Program

The General Electric Company's new "Residential Market Development Operation" will give powerful support to the "total electric home" concept and the industry's Gold Medallion Home program. The company predicts that 137,000 of the expected 1.1 million housing starts in 1960 will be Medallion Homes (i.e., meeting certain established industry standards for adequate wiring, lighting and electric appliances). Of these, 107,000 will be Bronze Medallion Homes and 30,000 Gold Medallion Homes.

Sales of manufacturers' equipment in the average new home is estimated at \$575; in the Bronze Medallion Home, \$1,060; and in the Total Electric Gold Medallion Home, \$3,020.

A program of national advertising will begin early in 1960 covering lighting, appliances, heating,

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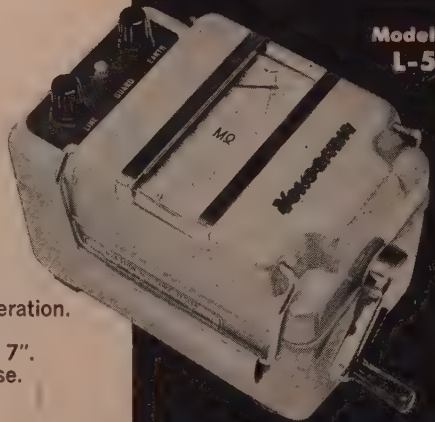
(Core Magnet System)

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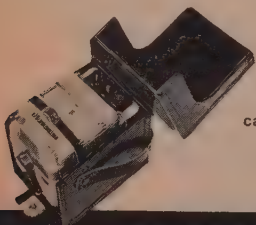
Nylon gear, smooth silent operation.  
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Model L-5

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- Wiring
- Switches
- Motors
- Capacitors
- Circuit Breakers, etc.



carrying case and leads optional

Write for literature

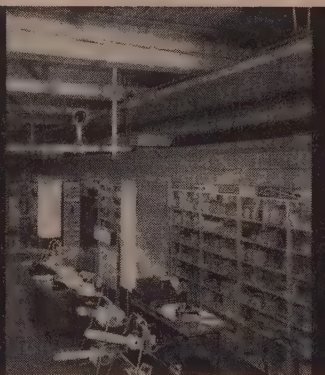
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Yes! I would like to know more about AIM Brand Slotted Angle and how I can gain **FREE MANPOWER HOURS**. Please send me AIM Brand Slotted Angle Idea literature.

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COMPANY \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_

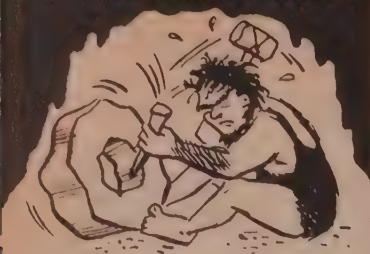


**AIM Brand Slotted Angle**



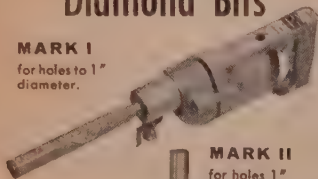


IT'S TIME FOR A CHANGE



NOW... drill masonry  
Faster, Safer,  
Easier  
At Lowest Cost  
with Mobile  
**DIAMOND CORING  
MACHINES**  
and  
"Thinline" Oriented  
Diamond Bits

**MARK I**  
for holes 1"  
diameter.



**MARK II**  
for holes 1"  
through 1 7/8" dia.



**MARK III**  
for holes to 6 1/2"  
diameter.



Drilling ammeter  
takes guesswork  
out of rock and  
gear feed.  
Drills vertically  
and horizontally.



Write for details on the Mobile MARK Series  
Diamond Coring Machines, "Thinline" Oriented  
Diamond Bits and accessories...

**MOBILE DRILLING, INC.**

Dept. 14  
960 N. Pennsylvania St.  
Indianapolis, Indiana



cooling and other elements of the  
Gold Medallion Home. GE spon-  
sored TV programs will also pro-  
mote the benefits of the all-electric  
home.

## Total Electric Home Program by Westinghouse

Westinghouse Electric Corpora-  
tion will spend \$3,000,000 during  
1960 in a nationwide program to  
increase public recognition of the  
Total Electric Home concept, ac-  
cording to Chris J. Witting, vice  
president in charge of the com-  
pany's consumer products group.

The new program is 20% larger  
than the 1950 Total Electric Home  
effort and will include a broad  
"package" of home plans custom-  
designed for electric living.

The Total Electric Home is one  
in which electricity is used as the  
only source of energy to heat and  
cool the home, entertain the family,  
prepare and preserve food and to  
reduce the amount of work that  
must be done to maintain a home.

"We're convinced that the future  
of the Total Electric Home is as-  
sured," Mr. Witting said. "The  
point that our 1960 program will  
emphasize is that it is available to-  
day—in any price range, any style,  
any size or any section of the  
country."

The program includes detailed  
plans for 16 Total Electric Homes  
that cover virtually every housing  
requirement. These will be built as  
model homes and they will demon-  
strate that any kind of home can be  
totally electric.



**THE PRESIDENT** and secretary of the  
Electric Club of West Virginia at a recent  
conference of NISA officers. A. D. Cop-  
pinger Sr., (right) Coppinger Machinery  
Co., Bluefield, W. Va., president; and  
W. M. McGlamery, (left) of the same  
firm, secretary-treasurer, of the club. In  
the back is Gene Johnson, Johnson Elec-  
tric Co., Great Bend, Kansas.

IT'S TIME FOR A CHANGE



NOW... drill  
**ONE-INCH**  
every  
**30 seconds**  
through  
**STEEL-REINFORCED  
CONCRETE**  
with the Mobile

**MARK IV**  
*hydraulic-powered*  
**DIAMOND CORING  
MACHINE**  
and Mobile "Thinline"  
Oriented  
Diamond Bits

**FASTER  
SAFER  
QUIETER  
DUST-FREE  
PORTABLE**

**EASIER  
TO  
OPERATE  
MORE  
ECONOMICAL**

**DRILLS VERTICALLY -  
DRILLS HORIZONTALLY**



Write for bulletin on MARK IV and complete  
Mobile line of Diamond Masonry Coring Ma-  
chines and "Thinline" Oriented Diamond Bits...

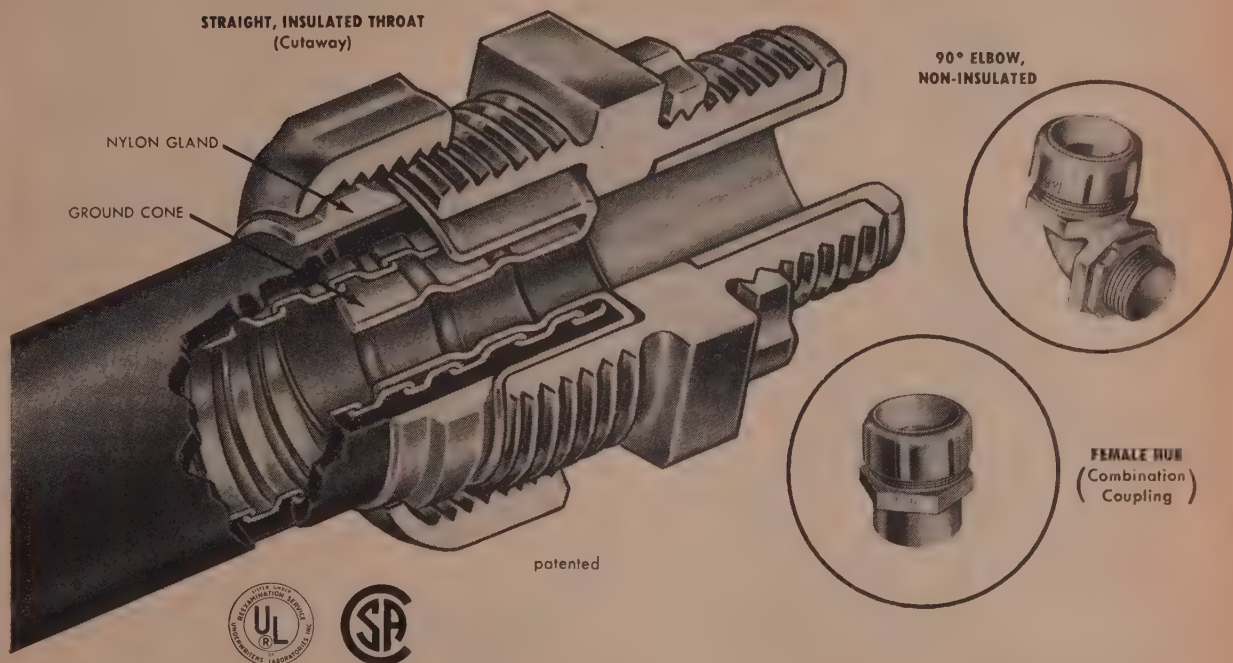
**MOBILE DRILLING, INC.**

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960 N. Pennsylvania St.  
Indianapolis, Indiana



# NEW LIQUID-TIGHT insulated CONNECTORS

fittings for LIQUID-TIGHT FLEXIBLE CONDUIT



**THE T&B LINE** provides a size range of  $\frac{3}{8}$ " to 4" in the straight, 45° and 90° angle types . . . both insulated and non-insulated.

\*Screw-in cone available from  $\frac{3}{8}$ " to 1- $\frac{1}{4}$ " sizes only at this time

A T&B Liquid-Tight connection can't be half safe. The mechanical strength, continuity of ground, and oil seal are all interdependent. Each gives positive assurance that you have all three. And T&B's more compact design means easier installation and improved appearance.

Your T&B distributor has this complete line in stock. Be sure to ask for a demonstration . . . or write direct to T&B for detailed specifications.

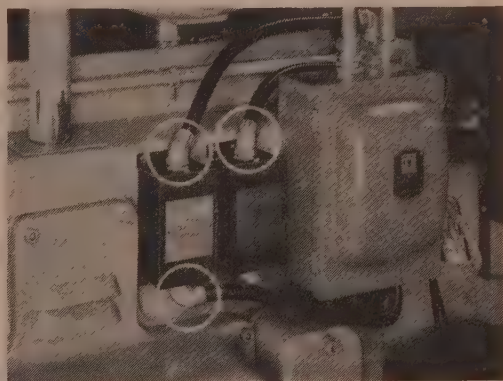
\* *Sealtite or equivalent*

**THE T&B INSULATED LINE** complies with all codes:

The National Electric Code (Paragraph 3736b)

J.I.C. Standards (Paragraphs 22.1.7 and 22.2.2)

Machine Tool Electrical Standards (Paragraph 22.1.7)



LOOK FOR THIS SIGN —



The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs.

IT'S THE MARK OF AN AUTHORIZED **T & B** DISTRIBUTOR

**THE THOMAS & BETTS CO.**  
INCORPORATED

34 BUTLER STREET, ELIZABETH 1, NEW JERSEY  
THOMAS & BETTS, LTD., MONTREAL, P. Q., CANADA  
MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898



# MISTER ELECTRICAL CONTRACTOR!

- YOU SHOULD BE IN FASTEST GROWING MULTIPLE MILLION DOLLAR PART OF YOUR CONTRACTING BUSINESS.

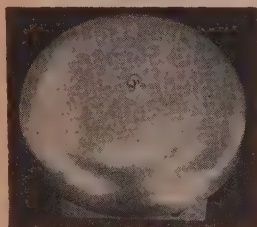
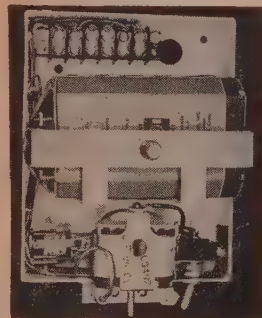


Photo showing 8 in. bell of LIFE SAVER SR. MODEL C1

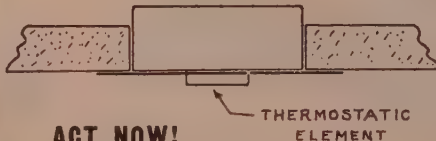


Inside view showing mechanism of MODEL C1

INSTALLATION OF FIRE ALARM SYSTEMS IN HOMES OR STORES—BOTH NEW AND OLD

We manufacture Underwriters' approved fire alarm thermostats, also home fire alarm panels and bells. Thermostats may be encased in ceiling with only small thermostatic element, which looks like a button, showing below the ceiling.

THERMOSTATS, PANELS AND BELLS AT MOST REASONABLE PRICES



ACT NOW!

WRITE FOR LITERATURE AND PRICES

FIRE ALARM THERMOSTAT CORP., 55 West 23 St., New York 10, N. Y.



OPERATING adding machine in the business office of the F. D. Hayes Electric Co., Lansing, Mich., is Robert J. Graves. Bob, whose title is that of office manager is responsible for all of the firm's "paper work," billing and other related office duties.

## Georgia Utility to Buy Service Entrances

Under a new wiring assistance plan the Georgia Power Co. will pay electrical contractors \$50 to \$200 for residential service entrances where the installed wiring system meets participation requirements. The plan was launched January 1 to encourage adequate wiring installations. Payments are scaled from \$50 for a 100-amp entrance to \$200 for a 200-amp entrance with electric space heat and an electric water heater.

The wiring installations are made by the owner's electrical contractor. At the completion of the work the utility pays the contractor the amount set forth in the plan and acquires ownership of the service entrance facilities. The customer pays the contractor the balance of the contract price.

The expected 1960 cost to the utility is \$4.5 million, based upon an estimate of 22,000 new homes, with 73% qualifying for service entrance purchase; 1500 new apartments and 12,000 qualifying modernizations in existing homes.

## MEA Announces Two Scholarship Grants

Two new scholarship grants have been announced by the Minnesota Electrical Association. This continues a memorial scholarship pro-

## INDOOR and OUTDOOR PHONES

that need no current



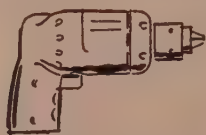
Your voice supplies the power needed to operate these Sound Powered Telephone handsets over a distance of many miles. Never fail in an emergency.

For temporary or permanent installation.



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**HOSE-McCANN**  
TELEPHONE CO., INC.

25th St. & 3rd Ave., Brooklyn 32, N.Y.



## Electric Tool Brushes

**HELWIG CARBON BRUSHES**

Protect your electrical tools with HELWIG BRUSHES. Equal in quality to original equipment. Stocked for immediate delivery. Write for catalog No. 97 and information on Special Tool Brush Kits and illustrated tool brush charts.

AVAILABLE NOW "RED CARPET" RUSH BRUSH SERVICE.

**HELWIG CARBON**  
PRODUCTS, INC.

2546 N. 30th St.  
MILWAUKEE 10, WIS.





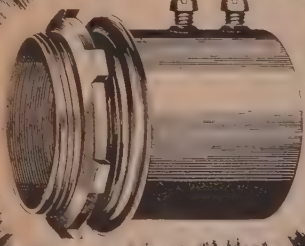
Permacel Vinyl Electrical Tapes for splicing wires, insulating bus bars, and countless other uses. Available in thicknesses from 7 to 20 mils, black, transparent or colored, with dielectric strengths of from 9,000 to 15,000 volts.

**PERMACEL®**

NEW BRUNSWICK, NEW JERSEY • TAPES • ELECTRICAL INSULATING MATERIALS • ADHESIVES



**NOW...all**  
**ETP**  
 fittings  
 are  
**Chrome Plated**  
**FOR LASTING PERMANENCE!**



**AT NO INCREASE IN PRICE!**

**Concrete tight! Every size connector and coupling up to 2". Why settle for ordinary fittings when ETP gives you all this:**

- New sparkling Zinc Chromate over-plating for lasting permanence. Salt spray tested to retard corrosion.
- Exclusive pre-set, deep-slotted STAKED screws. No backing out for conduit.
- Concrete tight with heaviest gauge wall thickness. U.L. file card E24788.
- Precision bevelled edges with extra heavy duty locknut.
- One piece solid tubular steel—cannot open or spread. Sized for uniformity.
- Available in 1/2", 3/4", 1", 1 1/4" (one screw type) and 1 1/2" and 2" (two screw type)

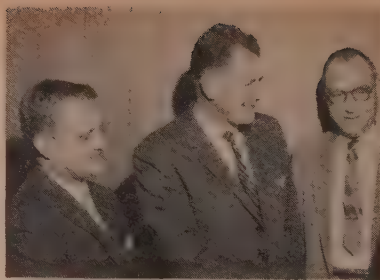
CONNECT WITH **ETP** FOR ECONOMY

**ETP**



**ELECTRIC TUBE PRODUCTS**

74-16 Grand Avenue, Maspeth (N.Y.C.), N. Y.



**AT A RECENT CONFERENCE** of officers of NISA chapter in St. Louis were: Al Martin, Zeller Electric Co. and Gerald Schaeffer, C. I. Schaeffer Electric Co., St. Louis, secretary and president of the Greater St. Louis Chapter; and Ralph Fuhrmann, Missouri Electric Works, Inc., Cape Girardeau, Mo., president, King Coal Chapter.

gram established in 1959 to encourage young men to enter the electrical field as future journeymen and master electricians. The scholarships are given in honor of former MEA members and other industry leaders. Selection of students who get the awards is entirely in the hands of authorities at the schools receiving the grants.

A new scholarship grant has been made to the North Dakota State School of Science at Wahpeton, N. D. This covers a term course for electrical wiring and is a memorial to the following men: E. J. Micka, Hibbing; Samuel Newstone, Montevideo; A. M. Kohler, Hibbing; and E. L. Harris, Minneapolis.

A second scholarship has been made to the William Hood Dunwoody Industrial Institute, Minneapolis, Minnesota. This also covers a full term course in electrical wiring and is a memorial to the following: H. B. Kline, Winona; Gifford Perry, Austin; Frank Beal, Worthington; C. P. Meyer, Melrose; F. M. Tripp, Minneapolis; and F. T. Langford, Minneapolis.

The Minnesota Electrical Association plans to continue this program by granting one or more annual scholarship awards in future years.

## NISA News

The Puget Sound Chapter of NISA went on record last December 1 as approving the change in the name of the National Industrial Service Association to "Electrical Apparatus Service Association." The change will become effective on April 1, 1961.

Walter O. Helwig, of Helwig Carbon Products Co., was the principal

speaker at the meeting which was held at Andy's Diner, Seattle, Wash. Mr. Helwig's topic was new uses of carbon in industry.

New England and Connecticut chapter will hold a joint meeting on March 19 at Hotel Sheraton Kimball, Springfield, Mass. Shop tours, speakers, movies, discussions of electronics drive servicing and motor control applications, an ideas contest and entertainment are on the program.

Plans for the spring meeting of North Central Chapter will be made at an informal gathering of members on February 6 at St. Paul Hotel, St. Paul, Minn. The spring meeting is scheduled for Minneapolis, April 22-23.

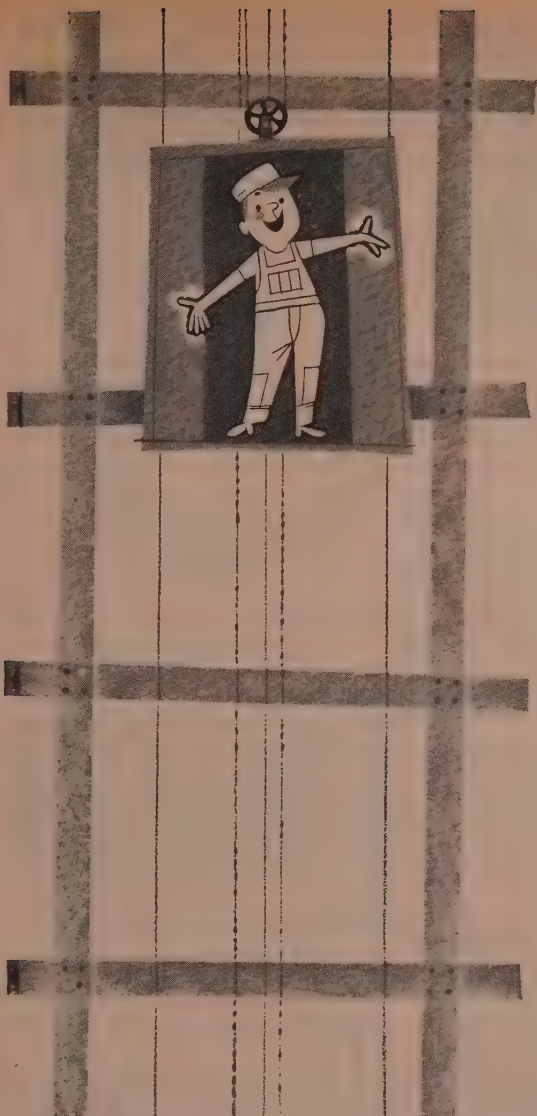
L. C. Gordon, Elgee Electric, Garden Grove, Calif., and Jerry Brewer, Industrial Electric Co., Bellflower, Calif. have joined Los Angeles Chapter. They were introduced to members at a meeting held January 12 at Michael's Restaurant.

NISA president Horace C. Blenkhorn was the principal speaker at a meeting of Quaker City Chapter at Beck's Restaurant, Philadelphia, January 27. The meeting was timed to coincide with the Plant Maintenance & Engineering Show at which the Quaker City group sponsored the NISA exhibit. Other guests included NISA engineer Arthur C. Roe.

A membership drive ending De-



**INDUSTRIAL GROWTH** in Florida was reviewed during a coffee break at the recent NISA annual conference, Southeastern Chapter, Raleigh, N. C. by (l-r): J. Lester Belcher, Jacksonville Armature & Motor Works, Jacksonville, Fla; Frank Spiegel, Brownell Distributors, Inc., Atlanta, Ga; J. Howard Lott, Orlando Armature Works, Inc; Orlando, Fla; and William "Bill" Brown, Brownell Distributors, Inc., Atlanta, Ga.



# NAME YOUR FLOOR

and General Electric can give you the underfloor wiring system that suits your electrical needs

General Electric makes four types of underfloor wiring systems—everything you need in order to handle any combination of electrical and structural requirements, in any size or type of building. The examples below show you which G-E system goes with each type of floor construction.

**EASY INSTALLATION!** All General Electric systems are designed for easy installation. For example, with the G-E single-level duct systems, center-duct runs can be fed through the conduit openings in the corners without need for field adaptations. Junction boxes can be leveled without removing the covers.

For valuable manuals with complete layout, design, product, and installation facts, mail the coupon now.

*Progress Is Our Most Important Product*

**GENERAL  ELECTRIC**

**1. For cellular steel floors:** The G-E cellular-steel floor wiring system permits outlets on six-inch centers throughout the floor area. Header duct also available for modified cellular floors combined with sections of roof deck.

**2. For concrete floors and standard layouts:** G-E's single-level steel standard duct system can be used in concrete fills as shallow as 2½ inches. Easy-leveling, durable junction boxes have large interiors for quicker wire pulling.

**3. For concrete floors and heavy electrical loads:** G-E single-level BIG DUCT boasts an 8½ square-inch cross sectional area to accommodate heavy power wiring and multi-conductor communications cables. Can be used in 3-inch minimum concrete fills.

**4. For concrete floors and maximum flexibility:** G-E's two-level duct system permits multi-location feeding without awkward conduit home runs. Feed through the lower level with distribution through the top level. The ideal solution to difficult feeding problems when 3½ inches of fill are available.

General Electric Company  
Conduit Products Department, Section CU90-218  
Bridgeport 2, Connecticut

Please send me the bulletins checked below:

- ☐ Single- and two-level steel underfloor systems.  
☐ Cellular-steel floor wiring system.  
☐ I have enclosed a description of my underfloor wiring problem.  
What do you suggest?

Name \_\_\_\_\_ Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_





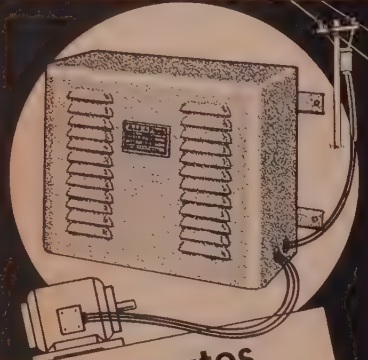
## PRECISION Engineered Fittings



**M. STEPHENS**

Mfg. Inc. Los Angeles 11  
814 E. 29th St. ADams 1-9147

## ADD-A-PHASE POWER CONVERTER



**Operates  
3 phase motors  
from  
single phase!**

- ✓ 100% RATED LOAD
- ✓ HIGH POWER FACTOR
- ✓ BALANCED CURRENTS

WRITE FOR DETAILS TODAY!

**SYSTEM ANALYZER CORP.**  
NOKOMIS, ILLINOIS



**AT A RECENT CONFERENCE** of NISA chapter officers in St. Louis, from left: Bob Sandman, Sandman Electric Co., Boston, Mass.; George McKeowan, MQN Electric Motor Service, Mentor, Ohio; and Don Fowler, Reserve Electric Co., Cleveland, Ohio.

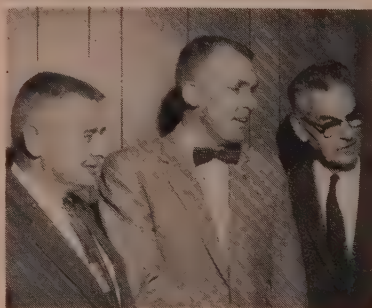
cember 31 netted 16 active and one associate members for Southwestern Chapter. A \$25 prize for the member recruiting the largest number of new members was won by James A. Phares, Southwest Electric Co., Oklahoma City, Okla.

The chapter's spring meeting will be held in Dallas. Connie Henry has been named general chairman for the event which is set for March 10-12 at Baker Hotel. Assisting Mr. Henry will be J. E. Hurt, Industrial Electric Equipment Co. Mrs. Gene Jackson is chairman of the women's program.

The chapter's fall meeting will be held September 22-24 at the Commodore Perry Hotel, Austin, Tex.

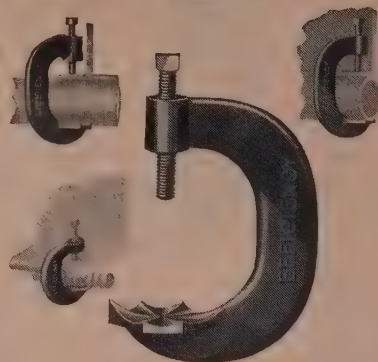
Fifty-five attended the meeting of Mid-South Chapter at Albert Pick Motel, Montgomery, Ala., December 4-5.

Twenty-three attended the meeting of Connecticut Chapter January 7 at Waverly Inn, Cheshire, Conn., to hear E. B. Steinberg, Relectone Electronics, Inc., talk on electronic control principles and the use of



**MIDWESTERN** shop men get together at a recent NISA conference. From left: Oliver Klemp, Electric Motor Service, West Bend, Wis.; James J. Anderson, A & P Electric Co., St. Paul, Minn.; and Thomas M. Paul, Paul Electric Co., Sioux City, Iowa, a NISA director.

## EFFICIENCY CONDUIT HANGERS for GAS · CABLE and AIR LINES



On Steel Construction, "Type F" hangers are best for carrying ½ to 2½ pipe and armored cable at any angle to beams.

**EFFICIENCY**  
**ELECTRIC & MFG. CO.**  
EAST PALESTINE, OHIO

## Millions of Steel JIFFY CLIPS Serving the Electrical Industry



**Specify  
MINERALLAC  
HANGERS, CLIPS,  
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Expert design, choice materials and controlled manufacture have built "top-service and longest life" into Minerallac Electrical Specialties. That's why the electrical industry "prefers Minerallac"... In steel and Everdur for hanging pipe, conduit, BX cable, etc.

Send for new literature and prices.

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**MINERALLAC**



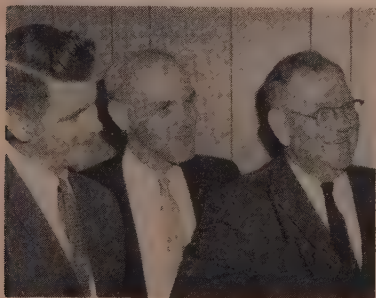
**MICHIGAN** motor shop men met at a NISA officer's conference recently. From left: C. S. Moran, Standard Electric Motor Works, Detroit; Mason Green, Barker-Fowler Electric Co., Lansing; and Paul Bogdan, Clement Electric Co., Grand Rapids.

power tube circuits in voltage control. A high pot demonstration was given by Vince Golia and Ed Piteo.

A panel of rewinding and trouble-shooting experts composed of Jay Almerico, Glenn Glave, Joe Ferrari and Abe Marcus led a discussion at the December 8 meeting of Chicago Chapter at Hotel Graemere.

Bernard Ferrari was reelected president and Sigmund Pluskota was reelected vice-president. Elected for the first time were: W. C. Luebker, secretary; H. W. Reeve, treasurer; James Beale, W. L. Kaska, A. J. Lewus, Walter Lucke, Jay Almerico, Elmer Jandt, Thomas Callaghan and Abe Marcus, directors.

NISA 50-year certificates were presented to a number of persons who had served half a century in the electrical industry by President Horace C. Blenkhorn at a meeting on January 12 at Hotel Graemere, Chicago, Ill.



**AT A RECENT NISA CONFERENCE** in St. Louis were Bernard V. Ferrari Jr., Excel Electric Co., Chicago, Ill., Paul Sievert, Sievert Electric Co., immediate past-president of the association and president of NISA's Southeastern Chapter, and T. K. Preddy, of Electric Motor & Repair Co., Richmond, Va.



## CASH IN ON THE ELECTRIC HEATING BOOM!

WITH THERMADOR

BILT-IN

ELECTRIC HEATERS!

Electrical contractors who are alert to profit opportunities are recommending the installation of Thermador electric heating when they sub-contract with builders.

Here's why: public utilities and manufacturers are spending unprecedented millions to pre-sell electric heating to your buyers. Even the coal industry is conducting a large scale campaign to boost loads through electric heating. In most sections of the country, the cost of electricity for heating is now competitive with other fuels. It actually costs less to install electric heating as compared to other systems.

When you specify electric heating in your bids, choose the name that stands for electric heating...

**THERMADOR**...originator of the fan-type electric heater.

Thermador offers you a complete line of electric heaters for all applications. The well known radiant bathroom heaters and the new fan-type ceiling heater which requires no rough-in box...heavy duty and medium wattage bilt-in fan-type units which keep heat where it belongs, in the "living zone"...and the newest addition to the line, baseboard electric heaters with the largest heat transfer area available.

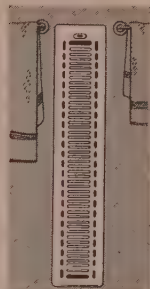
Fill in the coupon below for full information on Thermador electric heaters for home, office, apartment, factory, hotel and school.

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Originator of the Fan-Type Electric Heater



"Seven Leagues Ahead"



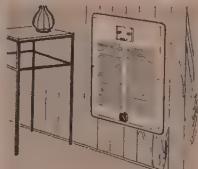
Full-Length Bathroom Electric Heater



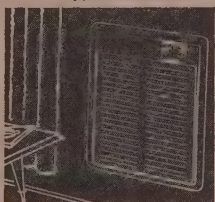
Space Saver Bathroom Electric Heater



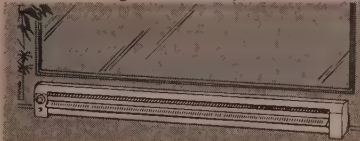
Ceiling Electric Heater



Small Room Fan-Type Electric Heater



Large Room Fan-Type Electric Heater



Baseboard Electric Heater

THERMADOR Electrical Manufacturing Co., Dept. 326  
A Division of Norris-Thermador Corporation  
5119 District Blvd. • Los Angeles 22, California

Please send me illustrated Bilt-In Heater literature.

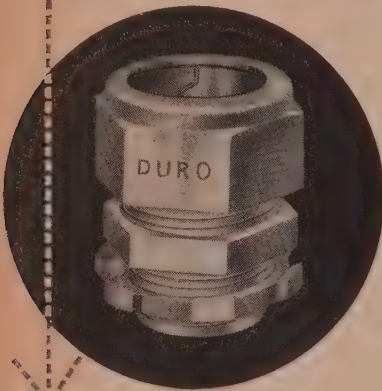
Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_



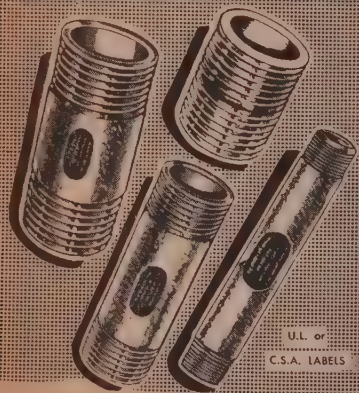
buy the only  
complete quality  
EMT fittings line  
from one  
dependable source



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U.L. or  
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1/2" to 6" sizes

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**ARTHUR DAVIS**, president of A. L. Davis Company, Inc., electrical engineers and contractors of Newark, N. J., relaxes in his private office at the company's new headquarters building. Here the general office area boasts a maintained lighting intensity of 150 footcandles and serves as an effective showcase for the firm's clients and customers.

## New Books

**The Practical Dictionary of Electricity and Electronics**, by R. L. Oldfield. 216 pages, \$5.95. American Technical Society, 848 E. 58th St., Chicago 37, Ill.

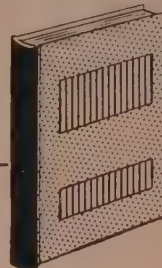
This book, in basic dictionary form, clears up troublesome terms in basic electricity and electronics, with many diagrams and drawings to help in visualizing the action or term being defined. In addition, many tables, symbol charts, and formulas most often used have been gathered together in an appendix and arranged for quick reference, including diagrams of such equipment as starters and regulators, transformers and power supplies.

**Engineering Manual**, by a staff of specialists, Robert H. Perry, editor-in-chief. 652 pages, \$9.50. McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y.

A practical reference of data and methods in architectural, chemical, civil, electrical, mechanical, and nuclear engineering. The architectural section contains extensive data on building electrical loads and distribution, lighting and refrigeration loads, demand factors, illumination levels, lighting fixture specifications, and signal systems. The electrical engineering section begins with basic circuit theory, explains network calculations, and presents machinery theory, including rectifiers and ac and dc motors and generators.

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**Edison Electric Institute—Sales Conference, Edgewater Beach Hotel, Chicago, Ill., April 4-6.**

**1960 Electrical Show for Industry—Cleveland Public Hall, Cleveland, Ohio, April 5-7.**

**Maintenance and Plant Engineering Conference—Chase-Park Plaza, St. Louis, Mo., April 25-26.**

**National Association of Electrical Distributors—Annual convention, Dallas, Texas, May 1-5.**

**National Industrial Service Assn., Inc.—Annual convention, Hotel Fontainebleau, Miami Beach, Fla., May 4-7.**

**National Fire Protection Assn.—Annual meeting, Montreal, Canada, May 16-20.**

**Pacific Coast Electrical Assn.—Annual convention, Stardust Hotel, Las Vegas, Nev., May 16-18.**

**Design Engineering Conference and Show—Statler-Hilton and Coliseum, New York, N. Y., May 23-26.**

**Edison Electric Institute—Annual Convention, Atlantic City, N. J., June 6-8.**

**New York State Association of Electrical Contractors & Dealers—61st annual convention, Whiteface Inn, Lake Placid, N. Y., July 3-8.**

**National Association of Lighting Maintenance Contractors—National conference, Milwaukee Inn, Milwaukee, Wis., August 22-24.**

**Illuminating Engineering Society—national Technical Conference, Penn-Sheraton Hotel, Pittsburgh, Pa., September 11-16.**

**International Association of Electrical Inspectors — Northwest Section, Sheraton-Portland Hotel, Portland, Ore., September 12-14; Southwest Section, Mapes Hotel, Reno, Nev., September 19-21; Eastern Section, September 26-28; Western Section, Continental Hotel, Kansas City, Mo., October 3-5; Canadian Section, Toronto, Ont., Canada, October 8-9; Southern Section, Rice Hotel, Houston, Texas, October 17-19.**

**Pennsylvania Electric Assn.—53rd annual meeting, Penn-Sheraton, Pittsburgh, Pa., September 20-22.**

**International Association of Electrical Leagues—25th annual conference, Hotel President, Kansas City, Mo., October 5-7.**

**National Electronics Conference—Hotel Sherman, Chicago, Ill., October 10-12.**

**National Electrical Contractors Association—1960 annual convention, Las Vegas Convention Center, Las Vegas, Nev., October 23-27.**

**National Electrical Manufacturers Assn.—Annual meeting, Traymore Hotel, Atlantic City, N. J., November 14-18.**

**Electrical & Home Appliance Show—Electrical Building, Balboa Park, San Diego, Calif., November 25-30.**

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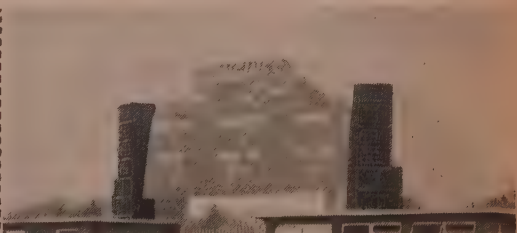
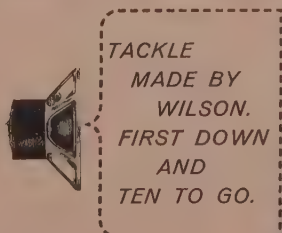
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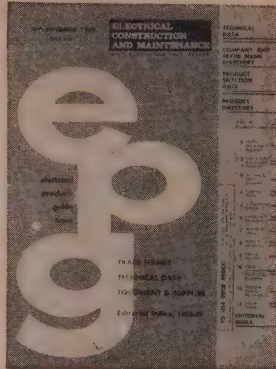
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### 2. PRODUCT SELECTION DATA

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| Protective Equip. & Wiring | Heating, Ventilating & Air Cond. |
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### 4. TECHNICAL DATA AND REFERENCE MATERIAL

Covers electrical symbols, diagrams, definitions, tables, formulas, and practical calculations used in electrical construction.

\* Subscribers received the Mid-September 1959 EPG as part of their regular service. A few extra copies are still available—when they are gone no more will be printed until next year's edition. Order several copies for your office and staff—only \$2.50 per copy.

**ELECTRICAL PRODUCTS GUIDE Issue**  
**Electrical Construction & Maintenance**  
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## DATES AHEAD

- National Electrical Week—National Promotion, February 7-13.**
- National Electrical Week Luncheon—**Sheraton-Astor Hotel, New York, N. Y., February 9.
- Power and Communication Contractors Assn.—15th annual convention,** Brown Palace Hotel, Denver, Colo., February 14-16.
- Upper Midwest Electric Industry Convention—**Leamington Hotel and Municipal Auditorium, Minneapolis, Minn., February 14-17.
- National Rural Electric Co-op. Assn.—**18th annual meeting, Kiel Auditorium, St. Louis, Mo., February 22-25.
- 16th Annual National Wiring Sales Conference—**Warwick Hotel, Philadelphia, Pa., February 25-26.
- International Association of Electrical Inspectors—**Rocky Mountain Chapter, Continental Denver Hotel, Denver, Colo., March 3-4; Mississippi Chapter, King Edward Hotel, Jackson, Miss., March 28-29; Virginia Chapter, Mariner Hotel, North Virginia Beach, Va., April 4-5; Ellis Cannady Chapter, Carolina Hotel, Raleigh, N. C., April 12-13; Alabama Chapter, Admiral Semmes Hotel, Mobile, Ala., April 25-26; Tennessee Chapter, Andrew Jackson Hotel, Nashville, Tenn., May 2-3; Florida Chapter, George Washington Hotel, West Palm Beach, Fla., May 5-7; Joint five chapter meeting North Louisiana-East Texas, Baton Rouge. George Welman, Texas Gulf Coast Chapters, Hotel Marshall, Marshall, Texas, May 6-7; Georgia-South Carolina Chapters joint meeting, DeSoto Hotel, Savannah, Ga., May 9-10.
- 5th National Electrical Industries Show—**New York Coliseum, New York, N. Y., March 6-9.
- National Construction Industry Conference—**Sponsored by Chamber of Commerce of the U. S., Chamber Building, Washington, D. C., March 10-11.
- Electrical Maintenance Engineers Assn. of California—10th Biennial Electrical industry show,** Shrine Exposition Hall, Los Angeles, Calif., March 23-26.
- American Power Conference—**Sherman Hotel, Chicago, Ill., March 29-31.
- Petroleum Industry Electrical Assn.—**32nd annual PIBA-PESA Conference and Exhibition, Municipal Auditorium and Muehlebach Hotel, Kansas City, Mo., April 12-14.
- Western Air Conditioning Show—**Western Air Conditioning, Heating, Ventilating and Refrigeration Exhibit and Conference, Shrine Exposition Hall, Los Angeles, Calif., April 27-30.

## Among the Manufacturers

### Headquarters Announcements

**General Electric Co.**, Schenectady, N. Y.—Robert L. Gibson, general manager, Transformer Div., Pittsfield, Mass.; Herman L. Weiss, general manager, Lamp Div., Nela Park, Cleveland.

**Crouse-Hinds Co.**, Syracuse, N. Y.—William J. Feahr, manager, Great Lakes Div., Cleveland.

**National Carbon Co.**, New York—Charles J. Chapman, vice president—marketing.

**NuTone, Inc.**, Cincinnati, Ohio—Harry Floyd, vice president.

**Westinghouse Electric Corp.**, Pittsburgh, Pa.—Edward T. Adams, manager of Rayescent engineering, Lamp Div., Bloomfield, N. J.

**Prescolite Mfg. Corp.**, Berkeley, Calif.—Stan Heywood, national marketing director.

**Anaconda Company**, New York—David E. Allen, executive vice president; William H. Benton, Jr., vice president, manufacturing; John L. Tindale, vice president, marketing and sales; Henry V. Van Valkenburg, vice president and general sales manager; William C. Kratz, manager, magnet wire manufacturing.

**Burndy Corp.**, Norwalk, Conn.—William E. Lett, export sales manager.

**Revere Electric Mfg. Co.**, Niles, Ill.—George J. Fauser, manager, service station lighting sales.

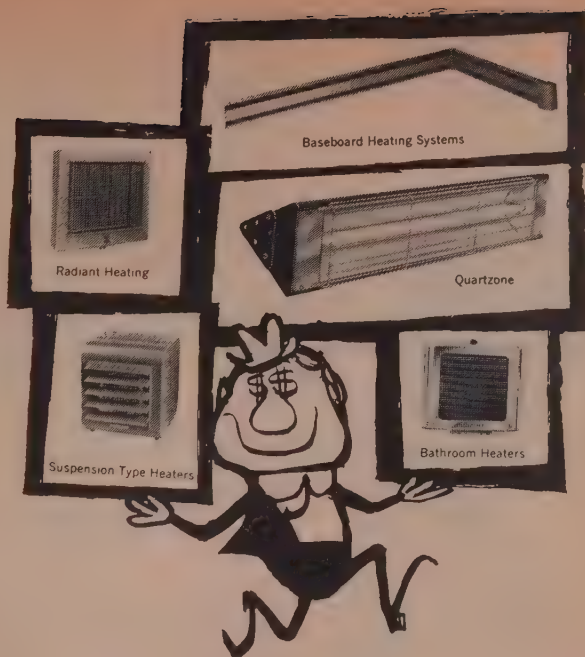
**Day-Brite Lighting, Inc.**, St. Louis, Mo.—John F. Ryan, sales training manager.

**Ridge Tool Co.**, Elyria, Ohio—William C. Parcell, executive vice president; R. D. Fye, sales manager; H. L. Palmer, advertising manager and assistant sales manager; Herman Weible, plant manager; Clarence T. Heintz, production superintendent.

**International Resistance Co.**, Philadelphia, Pa.—Walter H. Canfield, promotion manager, Marketing Div.

**Federal Pacific Electric Co.**, Newark, N. J.—Ralph J. Weiger, industrial sales manager; Armond J. Bisignani, Jr., marketing manager, General Products Dept.; Walter H. Niemann, marketing manager for laboratory switchboards.

**Youngstown Sheet and Tube Company**, Youngstown, Ohio—William E. Farragher, Jr., advertising manager.



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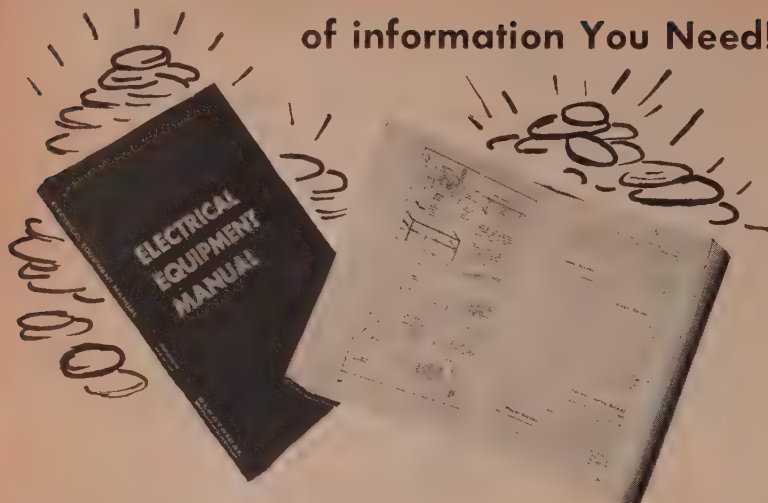
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### Regional Appointments

#### NEW ENGLAND

**Line Material Industries:** Richard L. Mansur, regional manager, New England region, covering Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut.

**Western Insulated Wire Co.:** D & F Sales Co., Boston, representative in New England area.

#### MIDDLE ATLANTIC

**Curtis Lighting Div., Curtis-AllBrite Lighting, Inc.:** Robert C. Simmons, representative for Rochester territory.

**Lake Shore Electric Corp.:** Elk Engineering Co., representative in Maryland, Delaware, and eastern Pennsylvania.

**White-Rodgers Co.:** F. J. Maney, New York district manager.

**A. B. Chance Co.:** Robert G. Niendorff, representative in New York area.

**Hevi-Duty Electric Co.:** R. L. Brown Associates, Inc., representatives for Transformer Div. in southern New York-northern New Jersey area.

#### SOUTH ATLANTIC

**Lake Shore Electric Corp.:** South East Engineering Services, Jacksonville, representative in Florida.

**I-T-E Circuit Breaker Co.:** John O. Brown, manager of new Birmingham, Ala., district office.

**Corning Glass Works:** Gordon A. West, lighting glassware sales representative in New Jersey, eastern Pennsylvania, Maryland, Delaware, District of Columbia, and Virginia.

#### EAST CENTRAL

**Western Insulated Wire Co.:** Electrical Sales Co., Chicago, representative in northern Illinois, northern Indiana, and Chicago; Larry Mooney, representative in Indianapolis; Fultz & Co., representative in Kentucky and southern Indiana.

**Jay Lighting Mfg. Co.:** Leon Goldberg, manager of Midwestern sales office, Skokie, Ill.

**A. O. Smith Corp.:** James E. Jackson, sales manager of Southeast and Central sales district, Electric Motor Div.

**Crouse-Hinds Co.:** Chester C. Pratt, regional manager, Detroit.

**Curtis Lighting Div., Curtis-AllBrite Lighting, Inc.:** Alva A. Togen, representative for Detroit area; John W. Wolfe, representative for Cincinnati area.



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**RETIRING CHAIRMAN** John Epperson of  
the IES Golden Gate Chapter was presented  
with "a slight token of appreciation  
for a job well done" by incoming  
chairman Walter G. Bayha at the first full  
meeting of the latter's new term of office.

### WEST CENTRAL

Western Insulated Wire Co.:  
Gaertner Sales, Inc., representative  
in eastern part of Wisconsin.

Lake Shore Electric Corp.: Slay-  
baugh-Thompson Co., representative  
in Denver, Colo.

Prescolite Mfg. Corp.: Donald  
Congdon, representative in Colo-  
rado and Wyoming.

White-Rodgers Co.: Harold E.  
Tettambel, Des Moines district  
manager.

Clark Controller Co.: R. F. Da-  
vidson, head of new New Orleans  
sub-office of Butler & Land.

Howell Electric Motors Co.:  
Robert E. Lee, manager of new  
sales office in Minneapolis.

Allis-Chalmers Mfg. Co.: New  
representatives: Warren W. Chap-  
man, Shreveport district; T. J.  
Curlee, Jr., Beaumont, Tex., dis-  
trict; Duane L. Miller, Amarillo,  
Tex., district; Warren D. Chinn,  
Minneapolis district; Donald H.  
Kuenning, Milwaukee district.  
Paul A. Dimberg, manager of  
utility sales and Hugh C. Blair,  
manager of industrial sales, New  
Orleans district.

### WEST

National Supply Co.: Fred E.  
Stabile and Sons, conduit and un-  
derfloor duct representative in  
Colorado, New Mexico, Utah, Wy-  
oming and part of Idaho; Jack H.  
Stumph, underfloor duct representa-  
tive in Oregon, Washington, Mon-  
tana and northern Idaho.

Hevi-Duty Electric Co.: Clyde P.  
Elliott Co., representative of  
Transformer Div. in Colorado-  
Wyoming area; Douglas E. Bolton  
& Associates, representatives of  
Transformer Div. in Utah.

Western Insulated Wire Co.:  
Jack Morgan Co., Inc., representa-  
tive in Texas.

## "More or Less" THE BEST



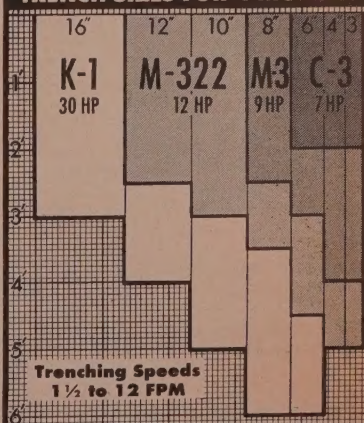
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LESS  
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M-322  
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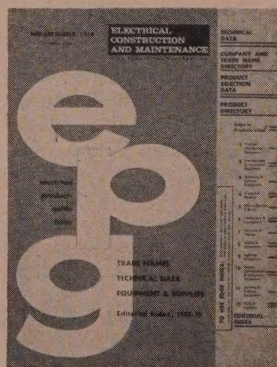
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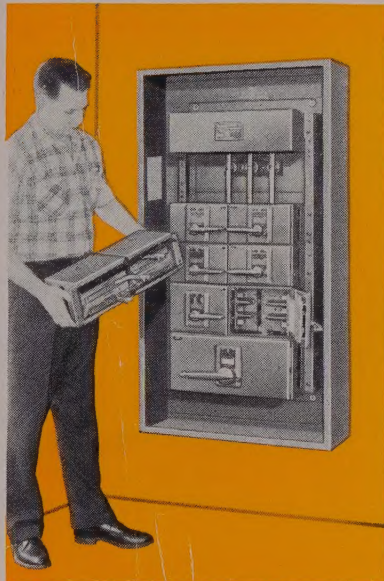
• These manufacturers advertised their products in the **ELECTRICAL PRODUCTS GUIDE ISSUE**

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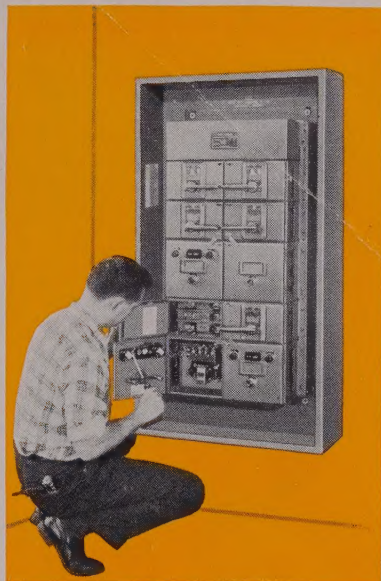
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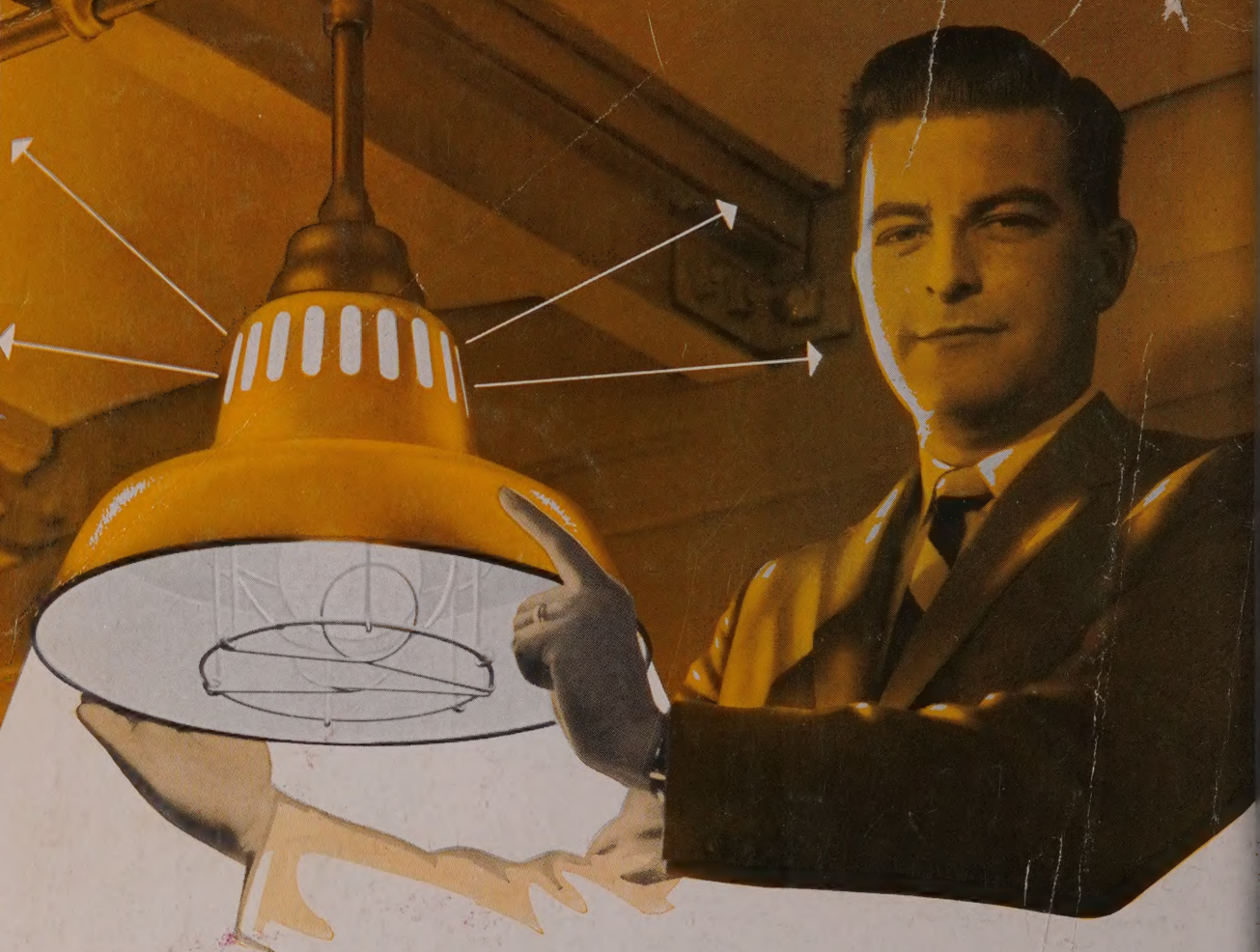
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